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GUIDELINES FOR THE PRACTICE OF LANGUAGE·SPEECH PATHOLOGY AND AUDIOLOGY

Report of an Expert Group convened by the Health Services and Promotion Branch

GUIDELINES
FOR THE PRACTICE OF
LANGUAGE-SPEECH PATHOLOGY
AND
AUDIOLOGY

Report
of an Expert Group
convened by the
Health Services Directorate
Health Services and Promotion Branch

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LIGNES DIRECTRICES POUR LA
PRATIQUE DE L'ORTHOPHONIE ET DE
L'AUDIOLOGIE

FOREWORD

In response to concerns expressed by provincial governments and others, the Department of National Health and Welfare brought together a group of experts to produce this report entitled GUIDELINES FOR THE PRACTICE OF LANGUAGE-SPEECH PATHOLOGY AND AUDIOLOGY.

These guidelines have been developed following a Canada-wide review process. National, provincial and regional professional associations, as well as practising professionals, across Canada, participated in this review. Hopefully these benchmarks will encourage continuing re-examination of existing practices.

This report is not a statement of federal government policy. It constitutes a part of the information base from which policies may be developed. It is hoped that the report will be a valuable guide to others in planning, setting policy on, and administering clinical activities in language-speech pathology and audiology. In this way the report may serve to enhance quality of care in these health services in Canada.

Further, the intent of these guidelines is not to formally standardize the delivery of services across Canada. It is neither the role nor the mandate of the Department of National Health and Welfare to implement these guidelines. Rather, the Department's role is to facilitate the development of a framework of common goals, practices, and procedures. Thus, implementation will vary provincially and regionally depending on human and material resources, and on policies and priorities of those provinces and regions.

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THE REVIEW PROCESS

As indicated in the Foreword, the first printing of this document (then entitled Clinical Guidelines in Language-Speech Pathology and Audiology) was disseminated to scores of individuals, associations, organizations, and institutions. In addition, the document was requested by a large number of individuals and groups. Critical comments were requested by the group of all recipients, in order to ensure that the revised edition would reflect the views of the professional communities.

As a result of the review process the group received over 200 specific comments indicating a need for correction, clarification, elaboration, or reduction in information. Approximately 25% of the responses were of a general nature, directed at such topics as the composition of the group, its terms of reference, and concerns about the French translation. The remaining comments specifically addressed the substantive portions of the text.

Every comment was reviewed by the group resulting in substantial changes throughout the document. No attempt will be made here to enumerate or specifically point out changes which were made. Obviously not all suggestions could be incorporated into this revised edition. Many suggested changes were diametrically opposed to one another; and in several instances, after due deliberation, the group disagreed with the suggested change.

The group members unanimously concluded that the review process affected the document in positive ways, and are grateful to their colleagues and others for their critical comments.

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LETTER OF TRANSMITTAL

February 10, 1982

Maureen Law, M.D., F.R.C.P.(C)
Assistant Deputy Minister
Health Services and Promotion Branch
Department of National Health and Welfare
Ottawa, Ontario
K1A 1B4

Dear Dr. Law:

It is my privilege to transmit to you the report of the Expert Group on Guidelines in Language-Speech Pathology and Audiology.

The Expert Group was established in January, 1978, with the agreement of the then existing Federal-Provincial Advisory Committee on Health Standards. The Group consists of eleven language-speech pathologists and audiologists, all members of the Canadian Speech and Hearing Association; two otolaryngologists, one representing the Canadian Medical Association and the other representing the Canadian Otolaryngological Society; one dentist representing the Canadian Dental Association; and one medical sociologist from the Department of National Health and Welfare.

The report describes recommended process guidelines for the practice of language-speech pathology and audiology. In addition guidelines have been developed for the practice of aural (re)habilitation. These guidelines, arrived at through consensus, and following a Canadian review process, were unanimously approved for dissemination by the Group.

I thank the members of the Expert Group for their valuable contributions to the guidelines and for their critical review of this document. I would especially like to thank Mrs. Eve Kassirer, Adviser, Institutional and Professional Services Division, for her continuous co-operation, expertise and counsel throughout this project. In this joint endeavour, the leadership and support of the Department of National Health and Welfare is greatly appreciated.

Yours sincerely,

D. Elaine Pressman

D. Elaine Pressman, Ph.D.,
Chairman,
Expert Group on Clinical Guidelines
in Language-Speech Pathology and
Audiology.

ESTABLISHMENT OF EXPERT GROUP

In 1977 the then existing Federal-Provincial Advisory Committee on Health Standards agreed that an Expert Group on Clinical Guidelines in Language-Speech Pathology and Audiology would be established. The then existing Health Standards Directorate, Department of National Health and Welfare, agreed to provide secretariat services including expertise in health care assessment. Subsequently, the Department of National Health and Welfare invited ten speech pathologists and audiologists, as well as representative from the Canadian Speech and Hearing Association, Canadian Otolaryngological Society, Canadian Medical Association, and Canadian Dental Associations, to form the group. Members were chosen on the basis of their expertise and broad representation on a number of variables as delineated below.

COMPOSITION AND REPRESENTATIVENESS OF THE EXPERT GROUP

The fifteen members of the Group comprise five language-speech pathologists and six audiologists, all members of the Canadian Speech and Hearing Association; two otolaryngologists; one dentist; and one medical sociologist from the Department of National Health and Welfare. Of the two otolaryngologists, one represents the Canadian Medical Association, and the other, the Canadian Otolaryngological Society. The dentist represents the Canadian Dental Association.

The characteristics of the group with regard to region, sex, language, citizenship, education, and occupational setting, are portrayed below.

CHARACTERISTIC	No.
REGION	
Eastern Canada	4
Central Canada	7
Western Canada	4
SEX	
Female	7
Male	8
LANGUAGE	
French	3
English	12
COUNTRY OF EDUCATION	
Canada	6
USA	6
Canada/USA	1
Britain/USA	1
Britain/Canada	1
MAJOR OCCUPATIONAL SETTING	
Academic	2
Clinical: Hospital	8
Clinical: Private	3
Government	2

TERMS OF REFERENCE

To develop guidelines for clinical practice in speech pathology and audiology by:

a) reviewing existing guidelines/standards in Canada and other countries;
b) identifying areas of practice for which guidelines are needed;
c) arriving at a consensus on existing and new guidelines;
d) preparing a review report;
e) carrying out a Canada-wide review process;
f) preparing an amended and enlarged report.

SCHEDULE OF MEETINGS

February 2 and 3, 1978	Ottawa
April 6 and 7, 1978	Ottawa
June 22 and 23, 1978	Ottawa
September 28 and 29, 1978	Ottawa
January 11 and 12, 1979	Ottawa
March 23 and 24, 1979	Ottawa
June 14 and 15, 1979	Vancouver
December 13 and 14, 1979	Ottawa
January 13 and 14, 1980	Halifax
January 30 and 31, and February 1, 1980	Ottawa
August 6 and 7, 1980	Halifax
December 4 and 5, 1980	Ottawa
March 12 and 13, 1981	Vancouver
August 27 and 28, 1981	Ottawa
September 13 and 14, 1981	Ottawa
October 23 and 24, 1981	Ottawa
December 10 and 11, 1981	Ottawa

ABSTRACT

Under the aegis of the Department of National Health and Welfare, a group of experts in the field of language-speech pathology and audiology was formed to establish guidelines for increasing and assessing quality of care.

Subsequently this group of experts developed consensus guidelines for diagnosis and treatment of communication disorders, classified into a five-fold taxonomy constituting: articulation, voice, resonance, fluency, and language. The group also developed consensus guidelines on levels of competence and procedures in diagnostic, pediatric, educational, amplification, and industrial audiology. In addition, consensus was reached on guidelines on (re)habilitation of the hearing impaired. These consensus guidelines were designed to be relevant to an array of professionals practising in a wide variety of work settings.

RECOMMENDATIONS

Consequent to the preparation of this report, the Group recommends that:

I. A high level of quality of care in language-speech pathology and audiology be encouraged across Canada through the consideration of these guidelines.

II. Language-speech pathology and audiology services be made available in the north, and in other remote areas, in addition to the more populated regions of Canada.

III. Public and government awareness concerning the nature and effects of communication disorders and their management be enhanced.

IV. These process guidelines in the field of language-speech pathology and audiology be supplemented by outcome measures.

V. Accreditation criteria for centres for communication disorders be developed.

VI. Research in the field of language-speech pathology and audiology be supported:

  (a) to encourage the development of new technologies to provide services not universally available across Canada at present;

  (b) to encourage the development of diagnostic materials, currently required and unavailable, and to provide normative data relevant to Canadian populations;

  (c) to encourage epidemiological studies on the incidence of language, speech, voice, and hearing disorders in Canadian population groups; and

  (d) to develop methods for prevention, early identification and intervention in communication disorders.

CHAPTER I: INTRODUCTION

The profession of language-speech pathology and audiology is committed to the concept of quality care for individuals with communication disorders. The guidelines which are presented in this manual reflect this commitment by the profession.

The guidelines set forth in this document are recommendations, arrived at through consensus of the Group. It is intended that the establishment of national guidelines for the clinical practice of language-speech pathology and audiology will be a mechanism for the encouragement of quality care on a coast-to-coast Canadian scale.

These guidelines are designed to reflect the current status of professional thought, tempered by an understanding of current acceptable clinical practice. They have been formulated at this time to represent reasonable requirements in clinical practice, for language-speech pathology and audiology. Concern for quality care and accountability by the profession of language-speech pathology and audiology reflects its stage of development and responsibility.

Historically, the profession of language-speech pathology and audiology has utilized the bodies of knowledge in the fields of acoustics, psychology, linguistics, medicine, and education. Consequently a variety of approaches has evolved, any one of which may be appropriate with a given patient. A specific interest in and a commitment to what is now known as communication disorders, with all of its multifaceted aspects, has resulted in the establishment of the profession. Today, the language-speech pathologist and audiologist is a professional in the field of communication disorders within the areas of health care and education.

Active research interest in language acquisition, disorders of language and speech, and auditory disorders over the past decade or two has had a significant impact on professional practice by furthering understanding of the development of the normal communicative process. This information has facilitated the development of more precise evaluative instruments and has encouraged an examination of therapeutic procedures.

1. DEFINITIONS

LANGUAGE-SPEECH PATHOLOGIST

A language-speech pathologist is a professional engaged in the prevention, evaluation, treatment and management of language, speech, and voice disorders.

Language-speech pathologists are also referred to as speech pathologists, language pathologists, speech and language clinicians, and/or speech therapists. The preferred term of the Group is language-speech pathologist. In general, the designation may be determined to some degree by the area of specialty in which they practise. In the interest of preserving the identity of the first label "speech pathologist", and of emphasizing the pre-eminence of language involvement in communication disorders, the Group has chosen the term "language-speech pathologist".

Language-speech pathologists may participate as members of interdisciplinary teams. They practise in concert with other professionals in a cooperative relationship. Referrals are generally in the form of consultation and/or requests for evaluation. Decisions about the specific nature of the patient's communication disorder and specific procedures for treatment are made by the language-speech pathologist. The language-speech pathologist may be involved in university teaching, in research with both normal and pathological populations, and in management. Work settings include universities, hospitals, schools, clinics, and private practice.

AUDIOLOGIST

An audiologist is a professional whose primary concern is auditory function. The principal effort is directed toward the identification, assessment and (re)habilitation of those with auditory disorders. An audiologist may also be involved in management of clinical programs, basic or applied research and hearing conservation. An audiologist may practice in a public or private clinic, school, university, industry, or hospital facility.

Audiologists may participate as members of interdisciplinary teams. They practise in concert with other professionals in a cooperative relationship. Referrals are generally in the form of consultation and/or requests for evaluation.

PATIENT

The term "patient" has been selected by the group to refer to the recipients of language-speech and audiological services. Although the group realizes that such terms as "client" and "student" are often deemed appropriate in certain work settings, the decision was made for the sake of uniformity throughout this document.

2. AREAS OF RESPONSIBILITY

Language-speech pathologists and audiologists engaged in clinical activities may be active in teaching, supervision, clinical investigation, and research. As professionals, language-speech pathologists and audiologists are responsible for the generation of new knowledge and specialized clinical skills. Although a young profession, its clinicians not only apply knowledge generated by other professions, but also generate their own information through appropriate research. Some institutions may not promote educational and research activities as well as the traditional clinical activities. This Group unanimously recommends that all three pursuits be encouraged and supported.

Professionals in language-speech pathology and audiology may be employed by school boards, hospitals, and special institutions. In addition, they may function alone in private practice, or in association with other professionals. They may be self-supported, or supported by federal or provincial governmental agencies. Practising clinicians should be aware of the legal regulations and statutes pertaining to their work place and their province. As with other professionals, language-speech pathologists and audiologists are legally responsible for their professional activities and conduct. In addition to legal liability, the language-speech pathologists and audiologists have an ethical responsibility in clinical practice. They inform the patient if an approach is experimental, innovative, or controversial.

Supervision of professionals within the field of language speech pathology and audiology should be by peer review. The development of this field has produced a high level of complex knowledge, expertise and research. As a result, assessments of clinical and research activities in this field are performed by peers.

PROFESSIONAL QUALIFICATIONS

Appropriate care of individuals with communication disorders is the concern of language-speech pathologists and audiologists. A requisite for practice is a university degree level of education and clinical training, including the specialized body of knowledge required to evaluate and treat individuals with communication disorders. In as much as language-speech pathologists and audiologists must interact with parents, family members, other professionals, and the general public, it is essential that they also possess adequate counselling and communication skills. The professional association of Ontario has instituted registration for professionals in this field in order to ensure a high standard of clinical training and practice; and currently, two provinces, Manitoba and Quebec, have legislated licensure requirements.

REFERRAL CONSIDERATIONS

Traditionally referral patterns have been determind by the regulations of the institution with which the professionals are affiliated. The majority of referrals are through physicians. However, many communication disorders are first detected by teachers in the preschool or school environment. Disorders are also detected by parents, patients themselves, and through screening programs.

No matter what the referral source, however, and in consonance with a philosophy that overall health care is optimal when coordinated through the patient's personal physician, the physician should be kept informed, and must be involved in the management of the communication disorder, where applicable. It is imperative that professionals work in harmony for quality health care.

PROFESSIONAL ORGANIZATIONS

In Canada, the profession of language-speech pathology and audiology has been organized at the national level since 1964; some professional associations were formed in some provinces even prior to this time. Currently there are ten provincial professional organizations in Canada and the membership of the Canadian Speech and Hearing Association numbers nearly 1,000 individuals.

3. CANADIAN NEEDS AND CHARACTERISTICS

In Canada, language-speech pathology and audiology is a young profession whose numbers of practitioners are few relative to the perceived needs. The majority of practitioners have been trained in Canada, England, France, and United States, but have responded to the specifically Canadian multicultural needs. The development of training programs in Canada has been influenced by differing approaches but the programs are increasingly addressing themselves to uniquely Canadian needs. Thus, throughout the deliberations, the Group tried to be sensitive to these needs and characteristics. Some of these are presented below.

a) Although standardized tests are not always utilized or necessary, many established diagnostic and treatment materials for clinical practice available in the English language are not readily available in the French language or in other languages spoken by a significant proportion of the Canadian population. It would be useful to have these materials available. In order to alleviate this situation, the development and standardization of adapted materials is necessary. This task will require support for applied research within the profession, not only to help develop these materials, but also to establish Canadian normative data.

b) The differences in health care delivery and educational systems among the provinces and the subsequent differences in registration, certification and/or licensure practices affect the practising professional. The Group is aware of these differences and understands that in the final analysis, the utilization will vary to suit the needs of each province.

c) Procedures which might be recommended in most urban situations might be impossible to fulfill in northern and other remote geographical areas where facilities or consultant specialists are available only hundreds of miles away.

d) In Canada, many individuals with communication disorders utilize more than one language as their primary verbal communication system. It is highly advisable that evaluative procedures be carried out in the patient's first language or mother tongue. In fact, the validity of any test result is in serious jeopardy whenever this is not the case.

GAPS IN SERVICE

There are certain gaps in the field of communication disorders in Canada, including the following.

a) Quantity and quality of services in rural and remote areas of Canada

b) Quantity and quality of services to the communication disordered population in the schools

c) Communication disorder specialists in the federal government to plan relevant programs in regions under its jurisdiction

d) Resources for existing training programs and for additional programs at universities

e) Resources for existing clinical service programs throughout the country

CLINICAL FUNCTION IN A BILINGUAL ENVIRONMENT

It has been found after considering successful clinical programs offering services in both English and French languages, that these separate programs can be run concurrently within a single clinic. Francophone therapists engage in clinical activity in the French language and anglophone therapists function clinically with an English speaking population. Complications arise when one clinician attempts to function in differing linguistic systems. It is strongly recommended that evaluation of speech, language, voice, and hearing be carried out in the patient's preferred language, and also that the professional evaluator of the communication system of that patient be a native speaker or have a "near native competence" in that language. Although many professionals working in the area of language evaluation have some degree of linguistic competence in another language, the evaluation of a language disorder (for example, a deficiency or deviancy in the linguistic system) requires a subtle and thorough decoding of the phonemic, syntactic and semantic system of the language. In evaluation, a familiarity and linguistic sensitivity is a prerequisite in an examiner. This ability is difficult (though not impossible) to acquire in a second language. Hopefully this will provide an improved quality of care and ensure whenever possible, that a language community will be served by professionals better able to meet its needs.

In evaluation, language-speech pathologists and audiologists in Canada must also be sensitive to the influence of interacting languages. This is especially significant in the evaluation of a young child's developing linguistic system.

Due to the many languages used in Canada, many English language tests of both receptive and expressive language function have been adapted to other languages. Normative data have been established for some of these adapted instruments; others are still in the experimental stage. Interpretation of these non-standardized tests can only be utilized as descriptive information in the evaluative process and cannot as yet yield developmental scores.

4. OTHER CONSIDERATIONS

PREVENTION

The concept of prevention is becoming increasingly more important in language-speech pathology and audiology. Borrowing from a preventive medicine or public health model, there are three general types of preventive strategies: primary, secondary, and tertiary prevention.

Primary prevention refers to strategies aimed at reducing the incidence of a disease, condition, or disorder. The concept rests upon the assumption that either cause is known, or that there is at least strong inferential evidence of cause or causative factors. Immunization against communicable diseases is an excellent example of the former; and the promotion of life style changes of the latter, such as diet and exercise as related to cardio-vascular disease.

Secondary prevention refers to strategies designed to prevent an already existing condition from developing into a more severe state or from developing secondary complications. This concept relies heavily on early identification and early intervention for its maximum utilization. It should be noted that the term "early" applies regardless of patient's age. Early identification and intervention are as important for a 50 year old patient with a brain tumor as for a five year old.

Tertiary prevention is a concept which is applied when a basic condition is irreversible, permanent, or stable, and treatment is (re)habilitative in nature. Treatment is aimed at gaining maximum functional ability and is preventive in that it is designed to keep the potential negative effects of a condition from occurring and dominating the quality of a patient's life.

The model described above has conceptional utility in language-speech pathology and audiology. To prevent the occurrence of a disorder; prevent the development of a disorder into a more severe form; or to maximize a patient's functional abilities in spite of a disorder, are all goals of the language-speech pathologist and the audiologist.

Primary prevention could focus on three areas: developmental disorders, preventable organic or medical conditions, and environmental stressors.

In addition to mass screening, the early identification and intervention strategies which should be considered by the language-speech pathogist and audiologist include:

1. public education regarding early signs of communication disorders, referral information, and availability of services;
2. professional education regarding identification and intervention strategies as well as referral patterns. These programs should be directed to various health care groups as well as educational personnel;
3. specific educational programs for parents of children at risk for communication disorders; and
4. continuing development of identification and intervention programming. Examples include facilitation of the transition between the identification process and the rehabilitation program for language impaired children; or the mass screening of citizens residing in long term care facilities or nursing homes. The latter is an example of tertiary prevention.

Language-speech pathologists and audiologists are aware of the fact that the communication status of many patients can change markedly over time. Particular examples are the laryngectomee and the stroke patient. Routine follow-up programs after discharge should be promoted.

With all of the above, it is important to ensure credibility and accountability. Even when it would require a longitudinal study to determine a program's effectiveness, it should be designed in such a way as to allow determination of short and long term effectiveness.

COMMUNICATION DISORDERS AND CONCOMITANT PROBLEMS

In this document, the various disorders of human communication are described and analyzed as separate entities. However, a communication disorder is frequently bound together, not only with other disorders of communication, but also with additional handicaps which may be motorically, intellectually, or emotionally based. When dealing with a person who has multiple handicaps it is therefore necessary to use the expertise of a multidisciplinary team. The choice of which disciplines should be consulted will be determined by the specific disabilities observed. The immediate and long-term needs of patients will alert the clinician to mobilize other resources within the community when those needs fall outside the realm of the clinician's expertise.

As part of the ongoing diagnosis and management of the patient it is important to monitor altering interactions among various disabilities and their components. Such changes may indicate the need to refocus the treatment. All recommendations should be made in the light of the total welfare of the patient, and take into consideration the family's perceptions of the greatest areas of need. Frequent conferences between the team members should allieviate the potential problems associated with conflicting opinions and demands. The designation of a primary case worker to convey information and interpretation to the patient and facility may enhance the clinical program.

5. SUMMARY

Language-speech pathology and audiology is a dynamic profession and consequently these guidelines will be subject to revision and modification as the profession continues to develop. Professional commitment is to a continuing process of self-evaluation, assurance of quality care and professional responsibility, rather than the preservation of these guidelines in their present form.

UNIT A

LANGUAGE AND SPEECH:
EVALUATION
AND
TREATMENT PROCEDURES

CHAPTER II: CLASSIFICATION OF LANGUAGE-SPEECH DISORDERS

1. PREAMBLE

In order to establish guidelines for clinical standards in language-speech pathology it was first necessary to conceptually frame the professional field. The framework which was accepted for the purposes of establishing the guidelines was arrived at after review of existing available materials. There was a concerted effort to accommodate various philosophical perspectives and to be acceptable to differing theoretical backgrounds of both the members of the Group and those in the community of language-speech pathologists in Canada.

The classification system utilized in this document provides categories which differentiate the disorders, allowing room for professional judgement on the part of the clinician.

This classification system which follows is not intended to be conceived of as either the correct one or the accurate one. It is intended only to be as comprehensive as possible and to provide a uniform conceptual framework for the sections on evaluation and management which follow. The system was devised only after protracted discussions of alternative schemes and considerable debate. The following illustration (Figure I) identifies those categories which differentiate the disorders. In addition, the areas of specialization and function of language-speech pathologists are represented. These areas include: screening programs for the detection of communication disordered individuals; general clinical practice (with a varied caseload); practice in one or more specific disorder (involving specialized assessment and/or treatment, and parent counselling); and educational and research activities. These areas of specialization do not represent hierarchical levels of competence although involvement in some areas may require a specialized educational background and/or additional training. Furthermore, as noted by the correspondence between sections, there is frequently interaction among the various clinical areas and clinical functions.

2. CLASSIFICATION*

A. Disorders variously known as: disordered language; deviant language; delayed language development; phonological, morphological, syntactic, and/or semantic problems; developmental or acquired aphasia.

Descriptive definition - varying degrees of difficulty in receiving, processing, interpreting, integrating, organizing, formulating or expressing symbolic information, when one or more of the following exist:

a) congenital central nervous system disorders;

b) acquired central nervous system disorders prior to complete development of linguistic skills;

c) acquired central nervous system disorders after complete development of linguistic skills;

d) lack of appropriate stimulation and emotional support in the home environment;

e) unknown cause and no concomitant disorders or factors.

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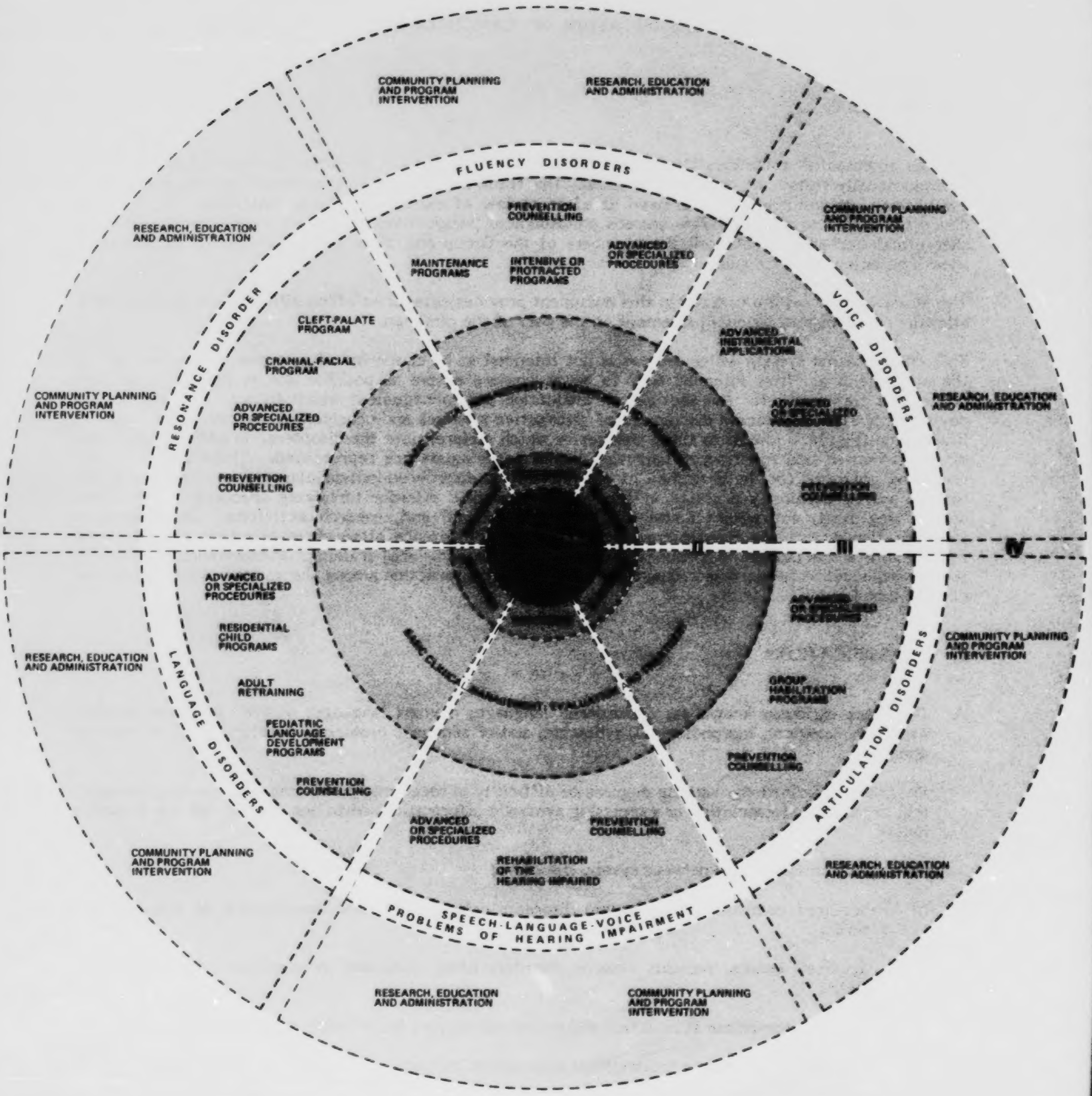
* Note that in each of the descriptive definitions in this section, a non-supportive or non-stimulating environment might be a contributing factor to the severity, or even the presence, of a disorder.


COMMUNITY PLANNING AND PROGRAM INTERVENTION
RESEARCH, EDUCATION AND ADMINISTRATION
FLUENCY DISORDERS
PREVENTION COUNSELLING
MAINTENANCE PROGRAMS
INTENSIVE OR PROTRACTED PROGRAMS
ADVANCED OR SPECIALIZED PROCEDURES
COMMUNITY PLANNING AND PROGRAM INTERVENTION
VOICE DISORDERS
ADVANCED INSTRUMENTAL APPLICATIONS
ADVANCED OR SPECIALIZED PROCEDURES
PREVENTION COUNSELLING
RESEARCH, EDUCATION AND ADMINISTRATION
RESEARCH, EDUCATION AND ADMINISTRATION
RESONANCE DISORDER
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ADVANCED OR SPECIALIZED PROCEDURES
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REHABILITATION OF THE HEARING IMPAIRED
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RESEARCH, EDUCATION AND ADMINISTRATION
COMMUNITY PLANNING AND PROGRAM INTERVENTION

FIGURE 1: AREAS OF SPECIALIZATION OF THE LANGUAGE-SPEECH PATHOLOGIST

B. Disorders variously known as: articulation problems, phonetic problems, speech sound production problems, dysarthria, oral-motor planning problems.

Descriptive definition - phonetic distortion, omission, or substitution, when competence for sound system is demonstrated; when one or more of the following exist:

a) acquired neurological disorders such as a cerebral vascular accident (stroke);

b) other congenital neurological disorders (such as cerebral palsy);

c) facial and/or palatal clefting and/or other severe dental, glossal, or maxillo-facial anomalies;

d) lack of appropriate stimulation and emotional support in the home environment;

e) unknown cause and no concomitant conditions or factors.

C. Disorders variously known as: voice problems, phonation problems, glottal wave form problems, laryngeal vibratory problems.

Descriptive definition - disturbances in phonatory frequency, intensity, quality, duration, initiation and/or cessation, and prosodic elements; when one or more of the following exist:

a) primary laryngeal pathology;

b) laryngeal pathology exists secondary to abusive or inappropriate functional use;

c) neuromuscular disorders;

d) primary cause involves behaviourally inferred learning or psychodynamic variables in the absence of organic pathology;

e) cause is unknown with no concomitant conditions.

D. Disorders variously known as resonance problems, upper vocal tract modulation problems, velopharyngeal closure problems and nasal coupling problems.

Descriptive definition - aberrations in oral-nasal acoustic output during speech, involving inappropriate modulation of the glottal wave form; when one or more of the following exist:

a) congenital or acquired disorders resulting in hyper- or hyponasal resonance;

b) nervous system conditions causing paresis or paralysis of sound modulation mechanisms, with particular reference to velopharynygeal mechanisms;

c) behaviourally inferred learning or psychodynamic variables play a causative role, in the absence of organic pathology;

d) cause is unknown with no concomitant conditions.

E. Disorders variously known as: stuttering, stammering, rate and rhythm problems, fluency problems, prosodic and timing problems.

Descriptive definition (one or more of the following) - repeating or prolonging of sounds or syllables; repeating of whole words or phrases, interjection of inappropriate sounds, words, or phrases; inappropriate intensity or frequency variations; inordinate pauses, hesitations, or silent periods, too fast or too slow rate of phoneme, syllable or word production; difficulty in phonation initiation or cessation; when one or more of the following exist:

a) cause is unknown but one or more of the following concomitants exist in varying degrees of development and severity:

   i) tension, hypertonicity, tremor, exist in the musculature used for speech;

   ii) general situational, or word and sound specific, avoidance and escape behaviours;

   iii) speech specific fear, anxiety, dread, apprehension states are self reported, behaviourally inferred, or found to exist through measurement techniques;

b) central nervous system conditions which influence motor planning or respiratory musculature (post cerebral insult, verbal fluency conditions - see Language);

c) combinations of elements in a) and b);

d) cause is unknown with no concomitant conditions.

F. Disorders variously known as: speech problems of the hearing impaired; language problems of the hearing impaired; speech, language and voice problems of the hearing impaired.

Descriptive definition - disorders of verbal communication among the hearing impaired involving one or more of the categories described above (A-E); when one or more of the following exist:

a) the hearing disorder is total or profound and congenital;

b) the hearing disorder is total or profound and acquired but prior to completion of the development of linguistic skills;

c) the hearing disorder is total or profound and acquired but after completion of the development of linguistic skills;

d) the hearing disorder is congenital or acquired but less than total or profound.

CHAPTER III: LANGUAGE AND SPEECH EVALUATION

1. PREAMBLE

Language and speech evaluation procedures establish the foundation for diagnostic decisions and subsequent construction of management procedures.

The guidelines presented in this document should not be interpreted as "prescribing" the procedural practices of any clinician. Certainly practitioners will exercise their right to professional judgement. Rather, the guidelines provide a framework against which individual practitioners or supervisors can measure the appropriateness of a wide-ranging variety of procedures.

The appropriate utilization of standardized test protocol is an area of professional concern. With the increase in number of test instruments which have become available, care must be taken that professionals are guaranteed appropriate ongoing training in administration procedures and interpretation of new test instruments. Caution must be exercised to prevent the inappropriate utilization of tests, and the inaccurate application of test data. Furthermore, the professional must appreciate and subscribe to the importance of consistent adherence to test protocol. Otherwise, the obtained data are invalid in comparison to normative data.

The following guidelines reflect the general approach to evaluation of the patient with a communication disorder.

a) Objective Recording of the Behaviour Status

Objective recording of the behaviour status of the patient when s/he first presents for evaluation may include: audio recording (minimally); videotape recording.

b) Case History Interview

It is essential that the clinician explore all relevant information which may be related to the presenting problem of the patient. A carefully taken case history can contribute significantly to a more appropriate understanding of the case. The case history should include an account of the individual's past development and current status. Care should be taken to document the validity of the information obtained. The following areas may be included:

1) Educational status
2) History and present status of the individual's communication disorder
3) History of speech and language development
4) Family history and present status
5) Birth and developmental history
6) Health history and present status
7) Social and emotional status
8) Relevant personality factors and social development
9) Family environment, familial and peer relationships
10) Adjustment problems if applicable
11) Interests and recreational activities
12) Occupational history; present status and plans.

c) Statement of Procedures of Evaluation

All evaluation procedures administered to the individual shall be clearly and concisely recorded. Where standardized testing is employed, the name of the test, (form where applicable) and any deviation from acceptable test administration procedures, should be noted. Where non-standardized testing is utilized, accurate descriptions of the objectives, procedures and client responses should be recorded. Areas to consider for evaluation can be noted in the next section entitled Diagnostic Tools. In addition to the parameters listed, procedures should include a statement reflecting the patient's degree of communicative need or motivation for communication; an evaluation of intelligibility; notation of any foreign or regional dialect; indication of language interference; and any emotional reactions accompanying speech.

d) Rationale for Evaluation Approach

A rationale, indicating the basis for the evaluation procedures to be undertaken should be stated. This includes an explanation for testing tools to be used (standardized or non-standardized), and the indicated relevance of test materials on the observed needs and capabilities of the patient as noted during the initial interview.

e) Rationale for Diagnostic Labels Used

A clear description of behavioural observations resulting in any diagnostic label employed should be stated.

f) Rationale for Additional Consultations

A clear rationale should be in evidence to support the need for additional consultations. Following this rationale the requested consultations should be stated.

g) Prognostic Statement

For each case evaluated it is clinically useful to make a prognosis of the estimate of probable outcome, both without therapy and with therapy. A conservative estimate as to the amount of time required to treat the problem might be attempted, and factors which might have an impact on the remediation process should be noted. Some evaluation regarding the extent to which the communication disorder can probably be remediated should be made.

h) Recommendations

Management recommendations should follow the evaluation in an orderly way.

2. DIAGNOSTIC TOOLS

The following selected diagnostic procedures are recommended as guidelines on speech, language and voice disorders. Some procedures are used routinely in evaluation; others are used only at certain times, at the discretion of the professional. Any and/or all of these diagnostic procedures may be used in any given case.

Some of these diagnostic measures involve standardized techniques; others utilize non-standardized approaches. When non-standardized approaches are used, it is imperative that the procedures and observations be carefully described and documented. Following is a list of procedures, measures, and areas to be evaluated.

a) Case History

A case history includes the following elements related to the problem: a discussion of the disorder; environmental factors; records, and other professional contacts; identification of the informant providing the case history data; and exploration of any additional relevant information applicable to the disorder.

b) Hearing Screening

This procedure involves basic audiometric screening at a representative sample of frequencies and at an appropriate intensity level for the specific environment.

c) Oral-facial Structures

Evaluation involves the description of the oral and facial structures including the lips, tongue, palate, teeth, mandibular and maxillary structures. Abnormalities, deviations, or developmental stages which might be affecting speech production or are of potential residual significance, are noted.

d) Oral-motor Function

Assessment includes an evaluation of diadochokinesis (alternate motion rates) both vocal and nonvocal for syllabic production; as well as range, direction, and precision of movement of the structures.

e) Speech Reflexes

Evaluation of speech reaction time, the presence of infantile or abnormal reflexes, or absence of normal oral-facial reflexes, are noted.

f) Velopharyngeal Function

Evaluation of voluntary and reflexive performance of velopharyngeal closure is made, noting degree of potential competency for speech purposes.

g) Aerodynamic Characteristics

Measures of nasal air flow, oral air flow and/or oral air pressure characteristics, as they relate to speech production, through use of aerodynamic recording systems are obtained.

h) Oral Praxis

Assessment includes an evaluation of the ability to produce simple and complex, symbolic and non-symbolic bucco-facial movements upon verbal command and/or imitation or through manipulation of real objects.

i) Articulation/Phonological Skills

An evaluation of speech sound production is done. This includes an inventory of correct and incorrect phoneme usage including a description of substitutions, additions, omissions, and distortions observed in speech. It may involve a description of elements of the phonological system utilized by the patient including the rules governing his sound generating behaviour. Distinctive features, co-articulation, and phonemic environment analysis, may be included.

j) Auditory Discrimination (standardized or non-standardized testing)

An evaluation of the ability to discriminate differences in auditory stimuli on acoustic and/or linguistic parameters is made.

k) Stimulability

The degree of the ability to modify and/or produce a behaviour after strong auditory, visual, motokinesthetic and/or verbal cuing is determined.

l) Oral Expressive Language Sample

A sample is taken of oral language production in both a spontaneous and standardized testing manner when appropriate. Observation made by other persons in the individual's environment (parents, family, teachers, other professionals) should be taken into account. An examination of the elements of expressive language including phonological, morphological, syntactic, sematic and pragmatic aspects are considered.

m) Receptive Language

The ability of patients to comprehend the language system in structured and non-structured situations is evaluated. Lexical (vocabulary-semantic), grammatical (morphosyntactic), and phonological (sound discrimination) components may be considered.

n) Written Language

The ability of patients to comprehend and produce (generate) language in the written mode may be evaluated. Both the form and the content should be considered in order to evaluate the functional use of language.

o) Receptive/Expressive Non-Speech Communication

The ability to comprehend and use non-graphic and non-speech systems of (language) communication is assessed.

p) Prerequisite Behaviours (non-verbal)

Such aspects as attending skills, cooperative behaviour, and communicative intent, may be described.

q) Vocal Imitations

The ability to imitate non-meaningful vocal production is determined.

r) Memory Variables

Auditory perceptual memory measures are considered, controlling for factors such as length of utterances, complexity of task and linguistic environment. Long and short term general memory may be evaluated, as well as memory for content and sequence.

s) Fluency Characteristics

Notation is made of rate, rhythm, and timing characteristics of speech including frequency, type, locus, and duration of dysfluencies, if present. Severity and non-verbal associated behaviours of dysfluency may also be considered.

t) Vocal Pitch and Pitch Range

Available pitch range, habitual pitch range, and appropriateness of habitual pitch level and range, are determined.

u) Loudness and Loudness Range

Available loudness range, habitual loudness range and their appropriateness are determined.

v) Voice Quality

Appropriateness of voice quality is noted and any perception of deviation from normal is documented. If instrumentation is available, additional information about phonatory events may be obtained.

w) Maximum Phonation Time

Measurement of the duration of sustained phonation after maximum inhalation.

x) Respiration

Adequacy of respiration for speech is observed and deviations are described and/or quantified.

y) Speech Laryngeal Motor Function

Coordination and synchrony of laryngeal function is determined.

z) Non-Speech Laryngeal Function

The ability to produce non-speech laryngeal valving functions including coughing, laughing, clearing voice and grunting is determined.

3. SPECIFIC DIAGNOSTIC MEASURES FOR DISORDERS

a) LANGUAGE DISORDERS

In evaluation the clinician should look for factors that could contribute to the maintenance of the language problem and try to determine those factors which may be modified or eliminated through intervention. The following areas should be considered and language characteristics of the community in which the individual lives should be identified.

1) Communication patterns prevalent in the environment.

2) The approach to be utilized in language evaluation (determined by the clinician's evaluation of the client's needs and environmental conditions). Such factors may determine the choice of such assessment techniques as direct or indirect; standardized or informal observation of behaviour.

When appropriate there should be investigation of the neurological and neuro-psychological status and pre-morbid levels of functioning in cases of acquired aphasia and in cases where there may be a neurological basis to the disorder.

In general, the following measures are recommended in the evaluation of an individual with a presenting problem of delayed language development, developmental or acquired aphasia and other instances of disordered language:

1) case history
2) hearing screening
3) phonological/articulation testing
4) oral-motor function
5) oral praxis
6) stimulability
7) auditory discrimination abilities
8) visual, oral and written expressive language skills in a spontaneous and/or elicited form
9) visual and auditory receptive language skills
10) non-speech communication skills when appropriate
11) visual and auditory memory ability
12) environmental factors

Elaboration of these recommended measures can be found in the section CHAPTER III 2: DIAGNOSTIC TOOLS. Clinicians may choose or recommend additional measures in accordance with their professional judgement and as a consequence of the perceived specific needs or complex problems of the client.

b) ARTICULATION/PHONETIC DISORDERS

In evaluation of articulation disorders the clinician should look for factors that contribute to the maintenance of the problem and try to determine those factors which may be modified or eliminated through intervention. In young children, it is especially important to consider the role of the normal development of speech sound production to determine if in fact a problem exists. In general the following areas should be examined.

1) Speech sound patterns prevalent in the home environment should be investigated.

2) Medical or dental problems which might significantly interfere with phonation or articulatory abilities should be noted.

3) Speech production characteristics of the language community in which the individual lives should be described.

4) There should be inclusion of the approach to be utilized in evaluation (dependent upon the clinician's evaluation of the client's needs). Evaluation approaches will be determined in part by the age of the client and may consist of formal or informal testing or observation of behaviour.

The following procedures are recommended in the evaluation of a client with problems known as speech sound difficulties, phonetic or articulation problems, or oral motor planning problems. These problems may be the result of structural difficulties (including hypoplasia of the tongue, dental malformation or removal of some part of the peripheral mechanism); neuromuscular difficulties, or central motor difficulties (apraxia).

Note: Phonological disorders which deal with a client's inability to understand and use the SOUND SYSTEM of the language are treated under the heading of language, in this document.

1) case history
2) hearing screening
3) oral/facial structural evaluation
4) oral motor functions
5) articulation phonetic skills
6) evaluation of auditory discrimination abilities
7) evaluation of stimulability to produce sounds
8) screening of language ability, orally
9) auditory memory abilities
10) environmental factors

Additional evaluation measures can be recommended when the phonetic disorder is the result of acquired or congenital neurological disorders. These include:

1) speech reflexes (where appropriate)
2) velopharyngeal function
3) non-speech communication when it is employed by a client
4) vocal imitations
5) neurological evaluation when appropriate
6) maximum phonation time
7) respiration
8) praxis

Individuals who are experiencing phonetic/articulation difficulties as a result of the syndrome of facial and/or palatal clefting require a thorough evaluation of velopharyngeal function. Wherever possible it is recommended that this evaluation be carried out in collaboration with a radiologist. As severe dental problems may accompany palatal clefting and interfere with speech sound production, consultation with a dentist is also recommended. Some centres currently have established teams of specialists to assist in the multidisciplinary evaluation of the patient with this problem. This approach is endorsed.

Elaboration of these recommended measures can be found in the CHAPTER III: 2: DIAGNOSTIC TOOLS. Clinicians may choose additional measures in accordance with their professional judgement in response to the client's specific needs.

c) VOICE DISORDERS

In evaluation of voice disorders the clinician should look for factors which may be contributing to the maintenance of the problem and try to determine those factors which may be eliminated or modified through therapeutic intervention. In an evaluation of a voice disorder it is important to consider the following:

1) If the patient has not been referred by an otolaryngologist who has commented on the dysphonia and its etiology, he should be referred by his physician for a laryngeal examination.

2) The status of the voice at the time of evaluation should be documented objectively through audio or videotape recordings.

3) An investigation of the psycho-social aspects of the person and his problems should be done.

4) A description of the observed vocal properties should be undertaken including the characteristics of pitch, vocal intensity, and voice quality. An evaluation of the appropriateness of age, sex and structural characteristics of a patient is also to be considered.

5) The patient (and his family where appropriate) should be counselled regarding: the severity of the voice disorder; its suspected cause(s); the nature of the recommended course of therapy; and the suspected outcome of treatment.

The following procedures are recommended in the evaluation of a patient with disorders known as voice problems, phonation problems, glottal wave form problems and/or laryngeal vibratory problems. These problems may be the disturbances in phonatory frequency, intensity, duration, initiation and/or cessation and/or include prosodic elements. These may be the result of pathological conditions, neuromuscular disorders, and/or behavioural or psychodynamic variables.

1) case history
2) hearing screening
3) oral structures evaluation
4) spontaneous oral language sample
5) vocal pitch and pitch range
6) loudness and loudness range
7) voice quality
8) maximum phonation time
9) laryngeal function during speech
10) breath holding and rapid onset of voice
11) degree of tension during phonation
12) respiratory patterns for phonation

Additional measures can be recommended when the dysphonia is a result of a neuromuscular disorder. These include an evaluation of respiratory function, and where appropriate an evaluation of speech reflexes. Other diagnostic tools may be used when the disorder is complex and involves variables which, in the clinician's judgement, require further evaluation.

Documentation of voice production via acoustic parameters (e.g. sonograph, frequency displays) is encouraged when the clinician has access to appropriate instrumentation.

Elaboration of these recommended measures can be found in CHAPTER III: 2. DIAGNOSTIC TOOLS.

ALARYNGEAL SPEECH

The most common condition leading to a need for a patient to learn alaryngeal speech is cancer of the larynx and subsequent laryngectomy. Other conditions exist but are rare.

Pre-Assessment

There is not full agreement among physicians and among language-speech pathologists about the wisdom of a pre-surgery visit to the patient by a language-speech pathologist, a successfully rehabilitated laryngectomee, or both. The dimensions of the controversy are well documented elsewhere (Boone, 1971); and clinicians are urged to learn about them. In any event, it does appear that authorities agree that the decision about whether or not a visit should occur, and by whom, is the perogative of the surgeon.

Assessment

The main objective in assessing the laryngectomee is to determine the "method of choice" for restoration of vocalization. In accomplishing a thorough assessment, consultation with the surgeon and/or surgical records, is often nearly as important as the examination of the patient. Variables to be considered are:

1. The extent of the surgery.

   Extensive loss of tongue base and of tongue mobility can interfere with deglutition, as well as articulation, and mitigate against successful esophageal speech. The extent of associated neck dissection may make the use of certain types of electronic vibrating devices more difficult.

2. The use of irradiation.

   Irradiation therapy directed at the site of the laryngectomy often leaves the neck tissues edematous, and tender thus mitigating against vibrating devices and, in some cases, causes discomfort making attempts at speech training difficult for the patient to tolerate. These effects diminish after several months.

3. The degree of healing.

   While early treatment is desirable, sufficient healing is crucial to minimize pain, or injury to the surgical site.

4. The degree of mobility and normal functioning of articulatory structures.

   With special regard to "glossal press" (injection method) and "bi-labial press" (swallow method) training methodologies, it is important that the tongue or lip strength and mobility are adequate. The mere ability to silently "mouth" speech-sound postures is insufficient for these procedures but may be sufficient for electronic devices or "inhalation" methods.

5. The patient's motivational and emotional state.

   Depression, fear of recurrence, fear of death, economic worries, self pity, pain and other affective states often follow laryngectomy and must be dealt with to maximize therapeutic gains.

d) RESONANCE

In evaluation of a resonance problem, the clinician should first look for determinants of the problem. Those factors which may be modified or eliminated through intervention, should be identified. The following areas should be considered:

1) The structure and efficiency of the velopharyngeal mechanism should be investigated. If appropriate, surgical and/or prosthetic management should be considered. This is achieved through close and continued consultation with medical and dental associates.

2) Consultation with professionals such as psychologists and psychiatrists may be considered when the resonance disorder is suspected to be behaviourally or emotionally based. In such instances involvement of the family as well as the client may be required.

3) Consultation with other health professionals may be required when the resonance disorder is related to a generalized neuromuscular problem. For example recommendations regarding positioning for optimal voice production might be desirable.

4) Prognosis for therapy should be realistic, and suggested techniques should be specific. Both should be clarified to the client.

5) The degree to which families or parents of the client are informed as to the nature of the problem should be determined. Implications of the recommended therapy program both for the client and/or themselves, should be clarified.

The following procedures are recommended in the evaluation of a client with problems known as resonance problems, upper vocal tract modulation problems, velopharyngeal closure problems, and nasal coupling problems. These problems may be the result of: congenital or acquired disabilities resulting in hyper-or hypo-nasal resonances; nervous system conditions causing paralysis of the velopharyngeal mechanism; learning, or emotional variables.

1) case history
2) hearing screening
3) oral structures
4) velopharyngeal function
5) articulatory inventory
6) stimulability measures
7) loudness and loudness range measures
8) voice quality
9) spontaneous oral language sample

Elaboration of these recommended measures can be found in CHAPTER III: 2: DIAGNOSTIC TOOLS.

Additional complex measures may be utilized in accordance with the clinician's evaluation of the client's needs and the complexities of the disorder. For example, consultation can provide cine or videofluoroscopic studies of the velopharyngeal mechanism. Further, examinations by consulting specialists may also be employed.

Since disorders of resonance are complex and frequently require the involvement of many different health professionals, formalized team consultations and evaluations are advantageous.

e) FLUENCY DISORDERS

In evaluation of fluency disorders, the clinician should look for determinants, and try to identify those factors which may be modified or eliminated through intervention. The following areas should be considered:

1) The fluency, rate, and timing characteristics of speech, with a description of the procedures used, as well as their results.

2) The relative frequency, duration, severity and types of dysfluency observed.

3) A descriptive statement of non-verbal behaviours such as facial grimaces, eyeblinking, and finger snapping which are consistently concomitant with the problems in this category.

4) A statement of rationale for diagnostic labels in this category, including the rationale for distinguishing among stuttering, cluttering, and bradyphemia, for example.

In general, the procedures listed below are recommended in the evaluation of an individual with a presenting fluency disorder of stuttering, stammering, rate and rhythm difficulties, dysfluency, or prosodic and timing difficulties. Such behaviours may include: the repeating of whole words or phrases; repeating or prolonging of sounds or syllables; interjection of inappropriate sounds, words or phrases; inappropriate intensity or frequency variations; inordinate pauses, hesitations, or silent periods; too fast or too slow rate of phoneme, syllable or word production; difficulty in phonation initiation or cesssation:

1) case history
2) spontaneous oral language sample
3) description of fluency characteristics
4) environmental factors

Elaboration of these recommended measures can be found in CHAPTER III 2: DIAGNOSTIC TOOLS.

An adequate assessment in this category (i.e., above and beyond the requirements for all evaluations) should include measurement procedures to determine the actual fluency characteristics of speech such as: number of words or syllables uttered per unit of time; number, types (e.g. repetitions, prolongations, interjections), duration, and relative severity of dysfluencies; appropriateness of variations in intensity and inflection; and the locus of dysfluencies or disruptions as related to voicing features, specific phonemes, phonemic environment and transitions, and grammatical structures. Measures should be gathered during both structured and non-structured tasks. Measures and documentation of fluency characteristics, non-verbal concommitants, environmental relationships, and affective states are seen as crucial to the later documentation of therapeutic outcome.

When dysfluencies are significantly present in the speech of young preschool children and young school age children in a developmental language period, additional measures of language testing (screening) are recommended. (see CHAPTER III SECTION 3 a). In addition, clinicians may choose additional measures in accordance with their professional judgement.

COMMENT ON NEUROGENIC SPEECH DISORDERS

Neurogenic speech disorders touch all aspects of speech pathology and audiology. A condition which can disrupt movement patterns of the head, neck and trunk can also affect the sensory systems of the same regions and in addition hearing, vision, smell and taste.

The clinician working with motor speech disorders must have a thorough knowledge of motor functioning, sensory-motor relationships as well as kinesiologic phonetics. In addition to these specific areas of expertise, the clinician should have available a complete rehabilitation team including a physiatrist, physiotherapist, occupational therapist and support staff.

Evaluation of motor speech dysfunction requires two types of measures: perceptual and physiological. Perceptual measures are taken by listening to the subject's production and rating the voice, resonance, articulation, prosody and consistency of the speech output. Physiological measures evaluate movement for strength, accuracy, range of motion and symmetry. All the muscle groups involved in speaking are included in the evaluation. In addition, normal and abnormal reflexes are noted. These measures, accompanied with a thorough case history are usually enough to determine the level of the disorder, whether it is progressive and which speech mechanisms need treatment.

The musculature of the face, lips, mandible, tongue, palate, and larynx can be evaluated for strength, co-ordination, accuracy of movement and position, range of motion, and asymmetry of function. These evaluations of the speech mechanism should be carried out during non-speech activity and during speech performance.

A complete and detailed history is of the utmost importance when the motor speech evaluation is to be correlated with the nature of the observed motor control which the patient demonstrates. Obviously such considerations as age, onset, course of the disorder or disease, and severity of involvement are important in this regard. Often, with a neurological diagnosis previously established, the motor speech evaluation is designed to indicate and reveal the status of the speech mechanism for speech performance, and indications for the initial stages of therapeutic program design.

In addition to the detailed assessment of motor control of the speech production sub-systems, the clincian should refer to the sections in this volume which are designed to suggest sufficient clinical activities for assessment of articulation, voice, and resonance disorders, since all or any of these components of speech can be effected by neurological impairment.

Differential diagnosis of neuromotor control problems in speech performance is difficult to make. The difference between dysarthria and apraxia, however, is one distinction which all practising clinicians should be able to make. The apraxic speaker does not demonstrate slowness or weakness or alteration of muscle tone in the speech mechanism and can generate movement patterns for reflexive and automatic performances within normal limits. The speaker with apraxia of speech, however, often demonstrates inconsistent phonemic production patterns from time to time on the same word or sequence of motor patterns. Errors in dysarthria are often explained by simplification or deletion, whereas the apraxic speaker often complicates his speech performance by substituting or adding or repeating elements.

AUGMENTATIVE OR ALTERNATE FORMS OF COMMUNICATOIN

In the past few years, considerable interest has been generated in working with persons who have severely limited potential for intelligible speech, or who require an alternate or augmentative communication system. Evaluation of such patients can be an extremely complex procedure because of the many parameters which need to be considered. In order to provide an indepth evaluation and appropriate recommendations, close consultation among many specialists is imperative.

ASSESSMENT

The main objective of assessment is to determine the potential for articulatory competence and linguistic sophistication within the context of motivation for communication and physiological limitations, thereby leading to a decision regarding the desirability of an alternate/augmentative communication system. The combined competence of the evaluation team should encompass expertise in assessing the following areas.

1) The potential for intelligible speech

Whether the individual being assessed is an infant, a child or an adult, careful consideration must be given to the etiology of the apparent lack of intelligibility of oral production. An awareness of the neurological status will assist in predicting the potential for improved intelligibility through maturation or regeneration (with or without therapeutic intervention). An extended period of diagnostic therapy or periodic review may be the only effective mechanism available for making such a decision.

2) Cognitive processing

The individual's awareness of the environment, the ability to manipulate concepts, the level of processing information from events in the environment (present, past and future integration), and the ability to consciously manipulate people and objects to achieve a desired result will provide an indication of the level of sophistication of the individual's cognitive processes. It is important to observe the individual's reactions in structured and spontaneous situations. This information will have great influence upon the type of coping strategies which may be considered. Information regarding educational history and intellectual functioning forms an integral part of this evaluation.

3) Motivation for communication

Motivation for communication should be assessed within the context of several parameters:

the individual's awareness of communication as a mechanism for controlling the environment
the individual's awareness of the rules of communication (turntaking etc.)
the expectation for communication from the people in the environment
the frequency of opportunity for communication
the ability of the individual's peers to process the communication strategies developed.

4) Linguistic sophistication

Evaluation of the individual's current level of comprehension of language and the type of expressive language used should be the first parameter considered. Subsequently the individual's ability to recognize and manipulate symbols, gestures and traditional orthography may be explored. The clinician should assess not only current competence but should also consider the prognosis for developing competence in the relevant systems. The pragmatic use of language is of paramount importance.

5) Physical limitations

In those individuals who do not have normal motor control of their limbs, assessment of various aspects of motor function should occur including:

optimal positioning for communication
accuracy and speed of movement
range of movement, particularly with reference to upper limbs and head control
visual awareness and visual field
usual form of locomotion.

If a communication system requiring the use of equipment is predicted, then assessment by orthotics and/or bio-medical engineering may be indicated in order to improve the ability to access the equipment.

6) Environmental constraints

Specific environmental demands may have a bearing upon the type of communication system(s) required. These demands may include:

the need for portability
the need for hard copy
the need for large group interaction
the need for telephone communication
the expectations of the family
the needs perceived by the individual

Following compilation of all the information listed above, the clinician can then discuss with the patient and the family the types of strategies which may be considered. The availability of a broad selection of communication aids is an invaluable adjunct to the evaluation process. Frequently an extended period of diagnostic therapy is required before it is possible to make a final recommendation for the most appropriate alternate/augmentative communication systems.

CHAPTER IV: LANGUAGE AND SPEECH TREATMENT PROCEDURES

(Remediation/(Re)habilitation)

1. PREAMBLE

A decision involving the management of the patient must be made subsequent to a language-speech or voice evaluation. Several factors should be considered prior to the recommendation and implementation of a treatment protocol. These factors relate to the anticipated relevance of the therapy to the disorder; the expected effectiveness of therapy; its feasibility in view of the physical, emotional, and social status of the patient; and the motivational level of the patient.

The following guidelines have been formulated; it is recommended that they be considered prior to the implementation of therapy.

a) Adequate therapeutic procedures should be utilized

A therapeutic procedure is considered generally adequate or appropriate if it is accepted clinical practice formally taught in recognized university or college programs (including short courses); and/or it is widely published in scholarly books, journals, or clinical handbooks authored by professionals. Treatment approaches that are clearly novel or experimental are acceptable provided that all appropriate mechanisms of informed consent are exercised. In addition, professional, institutional, and community standards and ethics must be satisfied.

b) When a therapeutic program is being designed consideration should be given to the total person and his environment including intellectual and emotional characteristics.

c) As a matter of general practice, decisions concerning specific treatment forms, modalities, or procedures, should be made by the language-speech pathologist in conjuction with the individual and his family.

d) Treatment procedures should be clearly consonant with the results of the evaluation.

e) Treatment programs should reflect the rehabilitative potential of the patient or be capable of generating positive benefits to the patient.

f) The recommended treatment protocol should be carefully documented on the patient's record, and ongoing thereapy should be charted. A final or discharge summary should be present when therapy with a patient terminates.

g) Treatment programming and procedures should be adapted in accordance with the ongoing changes as a result of therapy.

h) The nature of the recommended or ongoing treatment should be compatible with the available current information on the status of the patient.

i) Treatment programming should be compatible with the recommendations of other health care or educational consultants involved in the evaluation process.

j) Treatment protocol should be rehabilitative relative to the environment of the patient and consonant with his geographic and economic milieu. In the case of school age children, the educational environment should be taken into acount.

k) Coincident with treatment programming for adults with speech and language disorders, the family and/or responsible nursing staff and other professionals should be kept informed of the patient's level of functional communication. They should be instructed in the most effective modes and levels of communication both receptively and expressively.

l) As soon as a language delay or problem is suspected, parents or parent substitutes should be offered some practical suggestions to help develop or maintain communication skills. Parent involvement in the therapeutic program is particularly crucial with pre-school age children.

m) Periodic re-evaluations and therapy maintenance programs are recommended in order to monitor the gains of the therapeutic process, and hinder behavioural regression.

When the etiology of a communication disorder is obscure, when diagnostic batteries are difficult to administer, and/or when the clinician is unable to establish a prognosis, a limited period of diagnostic treatment should be considered for recommendations. This period, generally not exceeding twelve weeks initially, will enable the clinician an extended period of observation from which clinical judgements and subsequent management programs may evolve.

If quite different but acceptable approaches to therapy are possible in a given clinical situation, it is recommended that the patient be informed of the alternate forms of therapy. Motivation is basic to the success of any program. Depending on the orientation, various ways of developing motivation can be considered. A clinician may wish to use extrinsic reinforcement but the goal should be the development of intrinsic reinforcement to ensure the maintenance of the acquired behaviours.

The majority of available clinical services in Canada exist in publicly funded hospitals and institutions such as clinics and schools. As a result, treatment programs as currently available are often oversubscribed in many geographic regions in Canada. This situation has been noted to be particularly serious in some pediatric facilities, especially where specialized service programs are offered. High demands for available services demonstrate the fact that clinical treatment programs for communication disorders are underdeveloped.

2. SPECIFIC TREATMENT PROCEDURES FOR DISORDERS

The sections which follow offer guidance to the clinician with regard to a wide range of acceptable procedures for specific disorders. Detailed guidelines for each of these procedures is beyond the scope of this document. It is assumed that no clinician will engage in therapeutic programs without the appropriate academic and/or experiental background and/or consultation with colleagues recognized to be proficient in the treatment approach under consideration.

a) TREATMENT FOR LANGUAGE DISORDERS

PREAMBLE

Disorders of language include problems of varying degrees of difficulty in receiving, processing, interpreting, organizing, formulating and/or expressing symbolic information. One or more of the following areas of language may be involved:

phonology;
morphology;
syntax;
semantics.
pragmatics

Over the years, a variety of approaches to problems of language acquisition or recovery from acquired language deficits have been utilized. While these deficits are traceable to the language areas mentioned above, the approaches utilize a different conceptual framework. These approaches contain familiar terms such as aphasia, paraphasia, agraphia, alexia, auditory and vocal encoding, decoding and others.

Difficulties may be the result of a central nervous system disorder which is congenital; was acquired prior to the complete development of linguistic skills; or was acquired subsequent to the development of linguistic skills. In some cases of delayed language acquisition, no apparent concomitant disorders exist and the cause is unknown.

Many differing programs for language intervention are available commercially and in the professional literature. No one approach has been accepted by the professional community as the proven method. These programs range from a natural to a structured orientation. Programs may have a global language emphasis or focus on a specific linguistic area. In some programs, the form of language is emphasized; in others, language content or language function is stressed. Some programs attempt to integrate the form, content, and function of the language system.

Intervention approaches may be applied with language disorders due to various etiologies. Whatever the approach, the clinician must have a working definition of "language" and have a rationale for the content and procedures of the chosen treatment program.

GENERAL CONSIDERATIONS

Individual clinicians should select those treatment procedures which, in their opinion, will produce the best results for a particular patient. The immediate and long-term goals should be explained, where appropriate, to the patient, the family and/or other persons involved (teachers, other professionals). Treatment program considerations should include the following.

1) The activities of various professionals involved in treatment programs, when relevant, should be co-ordinated.

2) Commercially available programs should be adapted to the needs of the individual with the language disorder. The program should be consonant with the speech and language characteristics of the community in which the individual lives.

3) Facilitating environments for language acquisition or recovery should be encouraged through comprehensive programs directed at persons in the client's environment. This is essential in the case of young children developing their language skills as parents must become active participants in the language habilitation program for maximum gains to accrue. In the case of school aged children, clinicians should encourage the teachers participation. Such comprehensive programs include:
   a) counselling individually and/or in groups
   b) guidance in the use of techniques or approaches relating to language management and the development of communication skils.
   c) information concerning the nature of the problem, normal processes of speech, and language and other relevant topics.

4) Prerequisite abilities to speech and language acquisition or recovery should be developed when appropriate. In these cases, the clinician should carefully consider the relevance of this goal to the development of linguistic skills and/or alternate communication systems.

5) The alternate non-speech systems of communication when appropriate should be developed. This decision should be based on careful observation of the child or adult. A non-speech system may be complementary to oral communication or as an exclusive means of communication. It is recommended that oral approaches be tried and proved unsuccessful prior to the implementation of an exclusive non-oral system of communication for an individual.

THERAPY ORIENTATIONS AND RELATED STRATEGIES

Language has many interrelationships with cognition and communication. Individuals who are language disordered may present disturbances in one or more of these components.

Some strategies of the cognitive, linguistic and communicative orientations are presented below.

Cognitive Orientation

Within the rubric of "cognitive orientation", there are three types of intervention strategies.

Precursors to Language

Some language-disordered persons need to be taught nonverbal behaviours that are prerequisites to language. It is the clinician's responsibility to provide activities to help such individuals acquire or recover the attending and symbolic behaviours necessary to use language.

Learning Variables

People learn in different ways. Some learn more efficiently through one modality than another. Moreover, some individuals require mass practice, some require constant feedback of their output. The clinician should be sensitive to these sorts of learning variables.

Relevance of Non-Linguistic Stimuli

The form and content of language must be well integrated. In order to do so, the clinician must pay attention to the type of non-linguistic stimuli used. The stimuli, be they objects or pictures, must be appropriate to the level of functioning of the person, and be varied enough to establish the concept underlying the word or the sentence.

Linguistic Orientation

Under the rubric of "linguistic orientation," strategies, include the linguistic unit approach (phonological, morpho-syntactic and semantic), non-oral approaches to language intervention, and procedures to encourage linguistic development.

The principles guiding the selection of the linguistic units to be included in the language program should be their meaningfulness, their productivity in the language system, and the particular abilities or disabilities presented by the individual. The entry to the remediation process is based upon the results of the clinician's assessment. Integration and sequencing of these units must eventually be considered.

Oral Strategy

i) Phonological Units

The goals of treatment programs for the phonological aspect of language disorders include the development or remediation of the phonological system and/or the modification of the deviant phonological processes. When multiple deviant processes are present, treatment orientation is decided after considering the following factors:

1) the stability or consistency of the phonological problem;

2) the implication of the phonological problem for speech intelligibility;

3) the dependency of one deviant phonological process on another process;

4) the ability of the client to acquire phonological contrasts;

5) the degree of deviance of the processes;

6) the number of sounds in the class affected by the deviant phonological process;

7) the normal language acquisition data.

The clinician may decide to start training on one phoneme or on a few phonemes in the class. Whatever the decision, the clinician should base the selection of the phoneme(s) on the relevance of the factors listed above.

The above considerations guide the clinician in the elaboration of a program for the treatment of phonological disorders. Since the goal of such a program is the development of new patterns to be used in spontaneous speech, the clinician should also provide the individual with opportunities to use words of increasing length and complexity that belong to different grammatical categories. As early as possible, the client should be encouraged to integrate the newly acquired phonological patterns in spontaneous language, in natural contexts, and for different psycholinguistic functions.

ii) Morpho-syntactic and Semantic Units

Language development is characterized by variations in the order of acquisition and in individual styles for learning language. In addition, language disorders in adults are marked by variations in their clinical manifestations. Language in general is a highly dynamic function subject to various contextual influences. For these reasons, caution should be exercised by the clinician in any preprogrammed sequence of morpho-syntactic and semantic units and structures utilized in a treatment program.

For children with language delays or disorders, clinicians may choose to adopt a developmental sequence based on the information available about normal language acquisition; or choose to work on specific structures assessed as being deficient. In the case of programs using a developmental approach, the semantic units (words or phrases) are chosen according to their relevance for the particular individual and the particular context. The combinations into which the clinician sets these units should be based on a syntactic hierarchy that goes from the simple to the complex through a carefully graduated sequence.

In the course of the evolution of intervention programs, there has been a switch of emphasis from programs dominated by a syntactic approach to programs recognizing the importance of semantics and aiming at the integration of the semantic and syntactic systems. These programs also draw on available information concerning the development of these systems. It is the clinician's responsibility to be aware of current research findings in language development. Strategies should be adapted to the child's particular needs, taking into account the constraints (linguistic and non-linguistic) on the child's command of the semantic and morpho-syntactic systems. The words and structures used should enable the child to talk about objects, persons and events encountered frequently in the everyday world.

Intervention for adults presenting with language disorders, can also be oriented toward the re-acquisition of morpho-syntactic and semantic units and structures, meaningful units in appropriate grammatical sequences and used in the appropriate context. Sequencing of these units and structures can draw on different sources of information: manifestations of grammatical and semantic disorders as revealed by clinical observations; linguistic theory and taxonomies; psycholinguistics; and second language learning. Whatever orientation is adopted, the clinician should recognize two basic principles: language is an interactional process; and it is contextually bound. The intervention program must offer opportunities to vary the linguistic and referential contexts and provide for a form and a content that are meaningful and appropriate for the individual.

Non-Oral Strategy

Non-oral systems should be selected after careful consideration of language potential. These systems may be orthographic, representational at the lexical level, or may combine abstract and representational forms. This approach has been used with clients who have developed some linguistic competence but have disabilities which preclude the use of oral expressive language. Patients with neuromotor problems, hearing impairments, and/or specific neural associative problems which interfere with the development of an auditory verbal system, may be appropriate for this approach. Examples of such systems are: Blissymbolics; finger spelling; sign language; and communication boards.

Stimulation Procedures

Many procedures have been identified that can help the clinician structure his/her approach to language stimulation. The list that follows is merely suggestive and the clinician should be encouraged to use a variety of these and others, according to the needs of the individual. The following are examples of procedures which may be considered:

imitation
modelling;
expansion;
prosodic techniques;
parallel talk;
self talk;

sentence completion;
combinations of phrases and sentences;
question transformations; and
replacement of linguistic units.

Communication Orientation (Pragmatics)

The primary goal of language intervention is communication. The clinician should include, within the language program, activities that enhance the use of language for communication with different types of persons, in different situational contexts, and for different purposes. The communication situations created in therapy can be natural or contrived. Preference should be given to natural situations in which individuals are encouraged to manipulate a variety of stimuli with others. More structured situations may be needed for patients with severe or specific language problems.

The use of language is above all a communicative process. The speaker's choice of a linguistic form for a given utterance depends on the communicative intent, the non-verbal circumstances surrounding the utterance, and on the relationship existing between the speaker and listener. Procedures for assessment and intervention in language-speech pathology have been enriched by recent developments in the study of interpersonal speech acts, the structure of discourse, and the influence of non-linguistic contextual factors upon communicative acts.

In planning a language program, it is of the utmost importance that the clinician take into account the numerous variables determining the way an individual will need to use language. The program should be designed for the remediation of difficulties the client may be experiencing in the effective transmission of communicative intent, in maintaining the flow and referential logic of a conversation, and in respecting the social constraints which define the nature of a communicative act.

THERAPY APPROACHES AND METHODS OF INTERVENTION

Behavioural Approach

Some clinicians use behavioural principles both theoretically and clincially, whereas others may use behavioural priniciples only at the clinical level and espouse other theoretical orientations. The behavioural approach provides for the careful selection and sequencing of increasingly complex stimuli and responses. The control of reinforcement procedures for dealing with the elements of verbal behaviour is mandatory in this approach.

Psycholinguistic Approach

Clinicians using a psycholinguistic approach pay specific attention to language content and structures. Language programming is based on the knowledge of a hierarchy of language complexity.

Didactic Approach

Didactic approaches are based upon the assumption that the language system can be directly taught. Some approaches in second language teaching, including pattern practise drills, memorization of grammatical rules, and other rote and drill methods, are used.

Intermodality Transfer

Such approaches refer to training in the auditory-vocal (repetition), auditory-graphic (dictation), visuo-graphic (copy), and visual-vocal transpositions (oral reading).

Supportive Approach

This approach utilizes a natural milieu to reinforce and develop language skills. Parents, siblings, peers, teachers, nurses, houseparents and others in the individual's environment can be language facilitators. These facilitators provide stimulation for linguistic skill development.

Other Considerations

A therapy program may emphasize receptive or expressive language skills and focus on an imitative or spontaneous method to encourage language development or recovery. Motivation however, is basic to the success of any program. Depending on the orientation, various ways of developing motivation can be considered.

b) TREATMENT FOR ARTICULATION/PHONETIC DISORDERS

PREAMBLE

Prior to considering the implementation of an articulation therapy program (phonetic (re)habilitation), the clinician should determine that the disorder is in fact a phonetic as opposed to a phonological problem. In this document, the treatment of phonological problems is considered in the section on language disorders, while the treatment of phonetic disorders is considered below.

The guidelines in this section are considered appropriate when the speech sound production problem is characterized by an isolated learning, structural, and/or neuromuscular deficiency; and where competence in the sound system of the language is intact. Should an individual have moderate or severe difficulties with speech sound production, a language disorder is frequently a concomitant, and treatment should include the areas referred to under language disorders.

The sound production difficulties of the hearing-impaired person may be phonetic (discussed in this section) or phonological in nature.

GENERAL CONSIDERATIONS

When an intervention program for speech sound production is recommended, the clinician's selection of one particular method (or combination of methods) to carry out the program, should be dependent on:

a) the theory of articulatory units adopted by the clinician;

b) the theory of learning adopted by the clinician;

c) the role of receptive/expressive skills of the individual in retraining;

d) the modality that facilitates learning - that is, the auditory, the motor, the visual, the tactile kinesthetic or a combination of these modalities;

e) the presence or absence of concomitant neurological problems or structural abnormalities; and

f) the role of imitation in retraining.

A rationale for the intervention approach should be documented by the clinician and changes in the verbal behaviour of the client during the course of therapy should be recorded. In addition, regular progress reports documenting the efficacy of therapy and justifying continuance or discharge is expected as appropriate clinical practice.

Objective measures of verbal behaviour, (e.g. audio recordings) are advisable to document therapy progress and efficacy.

THERAPY APPROACHES AND RELATED STRATEGIES

The following approaches do not represent an exhaustive classification, but represent generally acceptable therapeutic approaches.

Elimination of Environmental Factors

Certain articulatory problems are a consequence of environmental models. If these effects are localized, as within a family, the clinician may provide therapy to modify the patterns. Articulatory differences which are present on a community-wide basis and constitute a dialectical variation are not considered a disorder. Individuals who may wish to modify their speech patterns to conform to a more "standard dialect" may desire assistance.

Elimination of Maintenance Factors

The clinician should look for factors other than environmental, which could contribute to the maintenance of the articulation/phonetic problem. These factors may include hearing loss, submucous clefting, thumb sucking, etc.

Choice of Sounds

When an individual has more than one defective sound, decisions must be made concerning what phonemes are to be treated first and in what order. A clinician should have a rationale for the approach taken. The following represent various clinical perspectives which may influence choices. These include:

ease of production by patient (stimulability) of specific phonemes;
heirarchy of intrinsic difficulty of production of phonemes;
co-articulation forces for target;
phoneme in isolation focus for target;
global approach to sound stimulation as opposed to individual phoneme focus;
visibility of the articulatory posture;
frequency of occurrence of the sound in a language;
a sound important to patient (e.g. sound in own name);
sound which fits group needs or teaching program of a class.

Direct Placement Approaches (Articulatory Phonetics)

This technique relies upon the principles of articulatory phonetics for direct teaching of sound production. The formation of the speech sounds (phonemes) and sound combinations (mainly through movements of the tongue, teeth, lips, hard and soft palates, and lower jaw) are described and demonstrated. Additional sensory stimulation may be used to aid learning.

Auditory Stimulation/Imitation Approaches

Auditory production of the target sounds is used as the prime medium of modifying production. This technique relies on the patient's stimulability (ability to produce target sound) to this type of input. Where imitative behaviour is difficult to elicit, this approach may not be appropriate.

Motokinesthetic/Haptic Approach

Motokinesthetic techniques (prompting of sounds through sensory manipulation of articulators) paired with imitation, can be used as a method to initiate sound production.

Visual Stimulation Approach

Visual feedback through matching of visual representations of acoustic output (e.g. adaptations of sound spectrographs, other visual feedback devices) are being utilized in therapy. This approach is generally used in conjunction with other auditory approaches where an individual has normal or some residual hearing. Visual stimulation in some speech sound production, through visually matching the patients production with the therapists model is also utilized as a technique.

Combinations of above

There will be times when clinicians judge that logical combinations of the above described procedures are in order. For example, the choice may be the dynamic, phonemic environment approach.

Behavioural Approaches

The programming of articulatory construction through behaviour modification programs has been used as a technique. Systematic data recording and the application of contingent reinforcement techniques have been applied to articulation therapy as has reinforcement techniques for successive approximations of sounds. For a further discussion of these techniques see Chapter IV Section 2 e.

Supportive Techniques/Counselling

In addition to the techniques outlined above, many therapists will counsel parents, teachers or other interested individuals concerning the problems. The progress of the patient as well as the procedures used by the therapist, should be explained.

Establishment and Transfer

Once the appropriate articulatory production is acquired by the individual, therapy may be directed toward integrating the phonemic into more complex linguistic environments (syllables, words, sentences and connected speech).

c) TREATMENT OF VOICE DISORDERS

PREAMBLE

Treatment of a person with a voice disorder should be initiated only after a number of preliminary steps have been completed. These steps include:

1) the opinion of an otolaryngologist on the cause of the dysphonia;
2) investigation of psycho-social aspects of the person and his problems, with recommended management alternatives being implemented as appropriate; and
3) counselling of person and family regarding degree and cause of the voice disorder, likely course of therapy, and outcome.

Audio (video) tape recording should be obtained at the initial assessment and at regular intervals during the therapy program. Voice therapy demands that a high quality recording system be available for evaluation of treatment progress.

GENERAL CONSIDERATIONS

Individual clinicians should select those treatment procedures which in their opinion will produce the best results for a particular patient. The immediate and long-term goals should be explained to the patient and family in such a way that agreement is obtained as to the attainment of the treatment goals. Such goals often include:

1) environmental changes to be achieved;
2) vocal abuses to be eliminated; and
3) voice parameters to be modified.

As the therapy program is being implemented, it is essential that the details of the treatment plan and the observed changes in voice function which occur, be included in the record. Changes in medical and psycho-social features of the patient and other pertinent information should also be systematically recorded. Throughout treatment the language-speech pathologist and the otolaryngologist should keep each other informed about the progress of the patient.

Since the causes of voice problems are frequently a combination of physical and psychogenic factors, consulting opinions and/or associated treatment which concern the patient from these other disciplines, should be obtained.

The decision to terminate voice therapy should be a mutual one among all concerned. The major responsibility for such a decision is with the professional, although the wishes of the patient should be respected. Considerations for discontinuation of therapy include:

1) improvement to normal or acceptable voice;
2) lack of adequate improvement; and
3) changes in medical or associated variables.

Following the conclusion of a voice therapy program, reports should be prepared and distributed to those persons who were involved in the original referral and/or who were consulted. Re-evaluation and other follow-up activities should be arranged with the patient and/or family.

THERAPY APPROACHES

Treatment approaches for voice disorders vary. These approaches will be considered under a classification system as follows:

Behavioural Approach

Behaviour modification approaches may be utilized by clinicians in the treatment of voice disorders. Such approaches may be particularly useful in eliminating or extinguishing vocal abuse behaviours. The application of stimulus-response contingencies in therapy are employed to facilitate the acquisition of normal or acceptable voice characteristics.

Traditional Approach

The stages in therapy from perceptual identification of unacceptable voice production to the production of normal voice, in increasingly complex linguistic environments and situations, may be viewed as a traditional approach. Motivation and reinforcement devices are often employed by the clinician to assist the therapeutic process.

Affective Approach

Some clinicians apply principles of psychotherapy, counselling, assertiveness training and/or other psychodynamic approaches to assist the individual to achieve changes in personal style. Such personal changes may be facilitating for voice improvement.

Supportive Approach

Family members, friends, teachers, employers and/or other individuals who can provide support to the person outside the therapy situation may be involved to assist in the modification of a voice disorder. In cases where the larynx and the vocal cords are unable to be used to provide voice, individuals who have solved a similar problem may participate in the treatment program.

Instrumental Approach

Various devices have been developed to assist the clinician to provide feedback to the person with a voice disorder. These instruments provide auditory and/or visual feedback of the acoustical characteristics of voice production. Through comparisons of clinician versus patient production, and/or patient production alone (with feedback), improved voice production may be facilitated. Other electro-mechanical devices are available to provide alternate pseudo-voice for appropriate patients.

THERAPY TECHNIQUES

Before beginning actual voice remediation, it is necessary to have a medical description of the condition of the larynx. Voice therapy is appropriate only in some laryngeal conditions. Furthermore, the effectiveness of voice therapy can be measured in some cases by the physical changes in the larynx subsequent to a therapy program.

Whether dysphonia is functional or organic in basis, voice therapy may not differ radically. Functional voice problems usually respond to the same therapy techniques as dysphonias related to tissue changes.

Voice therapy is applied in general, relative to the evaluative dimensions of pitch, loudness and vocal quality. The main goal of voice therapy is to search for a client's most appropriate and/or best possible voice production.

General requirements of voice therapy include continuous auditory feedback equipment such as a tape recorder or other feedback loop devices.

Voice therapy is recommended on an individual as opposed to a group therapy basis, especially with children. Ideally, several sessions per week should be held with patients. Frequent sessions are especially important in therapy with children.

Many acceptable therapeutic techniques may be utilized in voice therapy to facilitate optimum phonation. These may be used singly or in combination. Steps in therapy include general and specific facilitators. They are described below.

GENERAL FACILITATORS

Explanation of Problem

For therapy to be effective some explanation of the problem and suggested treatment is in order.

Auditory Training

Developing an auditory awareness of the sound produced is an important aspect of voice therapy. Many patients have difficulty hearing themselves and patients must become critical listeners of their own voice.

Relaxation Techniques

The goal of relaxation techniques is to reduce unnecessary tension. Relaxation technique is generally used in conjunction with other therapeutic techniques. Differential relaxation of particular sites of the body may be used, and combined with prolonged inhalation and gentle voice onset activities. A reduction in vocal tract tension generally results in a more optimum phonation.

Target Voice Models

The patient's own "best" voice or the clinician's voice can serve as a model. This goal can be utilized early in therapy when a patient can modify his voice to produce a more optimum pitch, loudness level and/or voice quality. This technique is useful in all areas of vocal rehabilitation.

Hierarchy Analysis

Anxiety producing situations in the patient's daily environment are ranked. This identification assists in an understanding of hypertension which may contribute to a hyperfunctional voice disorder.

Biofeedback

Where generalized tension is a factor in aphonia or dysphonia, relaxation therapy utilizing biofeedback devices such as EMG muscle tension and/or alphawave or brain excitation feedback, may be helpful.

SPECIFIC THERAPY TECHNIQUES

Elimination of Vocal Abuse

Identification and elimination of vocal abuses is an important aspect of dysphonia related to these abusive habits.

Elimination of Hard Glottal Attack

Hard glottal attack is particularly common among patients with contact ulcers and other posterior glottal pathologies and patients with other hyperfunctional voice disorders. Contrast with normal glottal onset is used to try to modify this abusive vocal behaviour.

Voice Onset Modification

This technique utilizes prolongation of phonation with a gentle onset of phonation. Patients with dysphonia, as a result of hard glottal attack, are potential candidates for this type of approach.

Yawn-Sigh Approach

This approach has a positive influence on pitch, loudness, quality and optimum voice production and is used with hyperfunctional problems of glottal approximation. The basis of the technique is in wide, stretching, opening of mouth plus yawn and gentle exhalation with light phonation. This technique is very helpful in hyperfunctional voice problems with or without vocal pathology for achieving some degree of vocal relaxation .

Digital Manipulation

This technique exerts external pressure on the patient's thyroid cartilage to help a patient establish a lower pitch. The pressure causes the thyroid cartilage to be tilted back slightly, shortening vocal folds and increasing size and mass of the cords.

Inhalation Phonation

Any patient not using true vocal fold vibration may profit from using inhalation phonation. On inhalation phonation the vocalization produced has been shown to be the result of the true vocal fold vibration. This technique has been successfully used with ventricular phonation and functional dysphonia.

Establishing New Pitch

Inappropriate pitch requires much effort. Modifying the habitual pitch to appropriate levels will have positive audible effects.

Change of Loudness

Where habitual use of inappropriate loudness has contributed to dysphonia and/or organic pathologies, modification of this quality through exercise and practice may be a facilitating technique.

Pushing Approach

Patients having difficulty with vocal fold approximation may benefit from pushing exercises. This technique may also enhance loudness and voice quality. Weak voices from systemic fatigue, unilateral cord paralysis, traumatic injury, myasthenia and bowing of the vocal cords, are generally helped by this technique. In exercises the patient moves from pushing exercises with hands to simultaneous pushing and phonating activities. Exercises should be progressively minimized after a patient can match the improved voice without the excess physical activity.

Negative Practice

The intentional use of a previously incorrect response has been described as a helpful method of facilitating carry-over of a new voice pattern to normal environmental situations.

Pitch Inflections

Increase of amount of pitch variability is suggested for patients with inhibition of natural inflection.

Respiration Activities

This technique has limited usefulness in voice therapy but some loudness and quality problems of the voice respond to activities which help the patient increase and extend expiratory air flow.

Masking

Occasionally, masking of the auditory feedback of a patient's voice may produce a more appropriate voice characteristic for modelling. Playback of this "voice" can be motivating for the patient and serve as a goal. Overmonitoring can produce an unnatural voice production and masking may be a technique to eliminate this problem.

Open Mouth Approach

Oral openness has been suggested to assist in reduction of vocal hyperfunction, and to encourage improved pitch, quality, and loudness characteristics of the voice.

Altering Tongue Position

This approach is recommended for a muffled or weak voice. Modification of tongue position may improve quality and resonance characteristics of the voice.

Chewing Approach

This approach is applicable to organic disorders such as nodules, polyps, contact ulcers, chronic laryngitis and aids in the reduction of vocal hyperfunction. Exercises alternate chewing and voicing in a manner that produces more relaxed voice production.

ALARYNGEAL SPEECH

Pre-treatment

Very often a considerable amount of time ensues between laryngectomy and training for alaryngeal speech, to allow for healing and general recuperation. The language-speech pathologist can assist the patient in communicating in the interim, utilizing note books, "magic slates", gestures, alphabet boards, exaggerated lip posturing and the like. Occasionally an "electro-larynx" can be utilized relatively soon after surgery even if it is not be the ultimate method of choice. Such early use should only follow consultation with the surgeon.

Treatment

Vibrating Devices

Some patients either can not learn esophageal speech or have anatomical difficiencies which prevent its efficient and/or comfortable use. For these patients the clinician may elect to train them in the use of pneumatic or electronic vibrating devices. Pneumatic devices require an air supply from the stoma which activates a vibratory source directed into the mouth of the patient. Electronic devices are of two general types; one in which the vibrating source is placed directly on the patient's neck transmitting sound through the tissues and the other in which an external vibrating source directs sound to the mouth via a tube. Detailed steps in the use of these devices as well as positive and negative features are readily available (Boone, 1971). Clinicians are cautioned about the use of devices which vibrate directly on neck tissues in cases where tenderness, inflamation, and incomplete healing exist.

Esophageal Speech

Three basic techniques exist which result in air being taken into the esophagus which can then be released in a controlled vibrating manner providing phonation for speech purposes. These methods are; the "injection" method, the "inhalation" method and the "swallow" method. Several texts (see reading list) describe these materials in detail, as well as drills and exercises for the acquisition and stabilization of vocalized speech production. Inexperienced clinicians or those with minimal academic and practicum training with laryngectomized patients, should consult the materials mentioned above as well as experienced colleagues or laryngectomees who have been trained as lay instructors whenever possible before undertaking therapy.

Various surgical techniques for the restoration of voice in those patients unable to sufficiently master esophageal speech are evolving and coming into more frequent use. A current example is the creation of a tracheoesophageal fistula and use of a one-way value prosthesis. There is general agreement that esophageal voice remains superior to these alternatives. It is also accepted that a close working liaison between surgeon and language-speech pathologist is essential to successful utilization of these techniques.

d) TREATMENT OF RESONANCE DISORDERS

PREAMBLE:

Resonance disorders refer primarily to the perceptual features of hypernasality and hyponasality, and have nothing to do with laryngeal phonatory function. Treatment plans for a person with these disorders should only be initiated after a number of preliminary steps have been completed. These steps include:

1) the medical assessment and treatment of conditions affecting the nasal passages, nasopharynx and palatalopharyngeal area;

2) a complete diagnostic evaluation of the nature and degree of the resonance disorder;

3) adequate consideration of the psycho-social and cultural features of the person and his family.

4) counselling of the person and family regarding the degree and cause of the resonance disorder, the likely course of therapy, and outcome.

Audiorecording should be obtained at the initial assessment and at regular intervals during the therapy program. In this area of speech difficulty, specialized diagnostic procedures may be required to determine the adequacy of function of the velopharyngeal mechanism. These procedures may include: aerodynamic assessment of oral and nasal airflow and air pressure; radiographic examination of the velopharyngeal mechanism, possibly including video fluoroscopic techniques; endoscopic examinations; and acoustical and perceptual studies of the nature and severity of the problem.

Some resonance problems are a consequence of environmental (family) models or may be present on a community wide-basis and constitute a dialectical variation. Resonance characteristics which are present on a community-wide basis are not considered a disorder for which therapy is recommended. Individuals who wish to modify their resonance patterns to conform to a more "standard dialect" may desire intervention.

The conditions of hyper- and hyponasality are most often associated with structural anomalies of the soft palate as in conditions of cleft lip/palate, inadequate or immobile soft palate, and conditions of craniofacial skeletal and structural deficiency. Such conditions require management on a team basis with other professional involvement. Often the team is located some distance from the home of the person with the disorder. Successful treatment requires close liaison and the professional co-operation of the language-speech pathology team member and the local clinician who will treat the person.

GENERAL CONSIDERATIONS

Treatment approaches will be considered under a classification system as follows:

- behavioural modification approaches
- traditional approaches
- affective approaches
- supportive approaches
- electro-mechanical approaches

Specific treatment techniques are described below.

THERAPY APPROACHES

Behaviour Modification

The behaviour modification approach, in a more strict application of stimulus-response contingencies often parallels the traditional approach. Toys and games may be incorporated into this approach. Token economy approaches are used to facilitate the acquisition of normal resonance patterns. (See Section III e).

Traditional

The traditional approaches to resonance disorders are often viewed as incorporating a series of steps which take the patient from the perceptual identification of the disordered versus the normal resonance feature through stages of a more normal resonance pattern. Successful productions of isolated phonemic, monosyllabic utterances to words, phrases, sentences, and connected discourse are also incorporated frequently. Motivational and reinforcement devices are often used to assist the process.

Affective

Affective or more subjective approaches often are employed to provide emotional or affective state changes, which can positively effect the resonance properties of an individual's speech production. Some clinicians apply the principles of psychotherapy, assertiveness training, and other such approaches to assist the person in achieving changes in personal style which are reflected in improvement in resonance function.

Supportive

Supportive methods can be viewed as employing certain individuals or situations to assist in the modification of a resonance disorder. Family members, relatives, friends, teachers, employers, clergy, and others can often provide invaluable support to a person outside the therapy situation.

Electro-mechanical

Electro-mechanical approaches in the management of resonance disorders are relatively recent in the modern era of language-speech pathology. Such devices as mechanical structural support for the soft palate using prosthetic dental appliances are incorporated where that expertise and technical support is available. Various acoustical measurement devices of oral and nasal resonance characteristics have been developed to assist the clinician and person in achieving improved resonance abilities.

THERAPY TECHNIQUES

A large number of specific treatment techniques have been described for resonance disorders. Steps in therapy include general and specific facilitators. They are described below.

GENERAL FACILITATORS

Counselling

Counselling is an ongoing process during the therapy period. It is used in combination with some of the techniques listed above to facilitate resonance improvement.

Target resonance models

This approach utilizes the skills acquired by the patient in auditory discrimination and auditory feedback training. Here, the patient's best resonance production or the clinician resonance properties serve as a model. This goal can be utilized early in therapy if a patient can modify the resonance properties of his voice production.

Hierarchy Analysis

Hierarchy analysis has been utilized to determine those situations in which a patient does relatively well in maintaining improved resonance ability and those situations and circumstances in which ongoing control of improved resonance is difficult. By approaching the problem of transfer and maintenance in a hierarchy analysis, the firm establishment of more normal resonance is facilitated.

Bio-feedback

Auditory feedback is an important, central and essential asset. Unlike other structures in the articulatory system, the soft palate is a poor sensory organ in terms of proprioceptive and tactile feedback.

SPECIFIC THERAPY TECHNIQUES

Auditory Training

The adequate and persistent application of auditory training for resonance properties is recognized as a powerful tool in the establishment of conditions favourable to change. An appreciation by the patient of the acoustical-perceptual properties of disordered resonance as opposed to normal resonance properties is an important prerequisite to change.

Articulation Training

Articulation training has proven to be an effective therapy approach with resonance disorders. This technique is designed to improve oral aerodynamic aspects of speech production.

Loudness Change

Some increase in loudness has been found to have a positive effect on decreasing nasality. This technique can be used as an adjunct to other therapy techniques.

Negative Practice

An important technique for establishing the initial stages of actual resonance alteration is incorporated in a method which is called negative practice. In this technique, the person produces a purposeful poor resonance utterance followed immediately by an attempt to produce a normal or near normal utterance. In this approach, the importance of an adequate perceptual identification of the difference between the two productions is critical. It has been observed clinically that even young children are capable of rather surprising amounts of resonance improvement by the adept and propitious use of negative practice.

Elimination of Hard Glottal Attack/Glottal Stops

The reduction and elimination of glottal stops as a replacement for oral stops is important to the intelligibility of speech. This use of glottal stops is a frequently associated feature in cleft palate speech and is sometimes modified through the replacement of hard glottal attack with a breathy attack.

Altering Tongue Position

Modification of tongue position may improve quality and resonance characteristics of the voice. Post surgical cleft palate patients may carry the tongue too far back in the oropharynx.

Direct Palatal Stimulation

These techniques incorporating blowing, sucking, and pushing exercises are sometimes utilized by clinicians.

Oral Openness

Oral openness is a facilitating technique to balance oral as opposed to nasal resonance properties.

OTHER CONSIDERATIONS

Secondary management considerations for cases of velopharyngeal insufficiency involve the language-speech pathologist because the remaining difficulty is most often a persistent degree of hypernasality. The language-speech pathologist is looked upon as a professional who can provide valuable opinion regarding the potential or prognosis for improvement in resonance function following such secondary management procedures as palato-pharyngoplasty or prosthetic obturation.

With the development of increased accuracy of assessment of the adequacy of the velopharyngeal mechanism, particularly with video fluoroscopy and fiberoptic endoscopy, the language-speech pathologist can provide advice to the surgeon as to the procedure likely to yield best speech results. Equally, if not closer, consultation between the language-speech pathologist and the dentist will result in the construction and fitting of a properly effective pharyngeal obturator.

After such management, the language-speech pathologist is responsible for continuing follow-up of the client to assure that maximum benefit is achieved.

e) TREATMENT OF FLUENCY DISORDERS

GENERAL CONSIDERATIONS

Treatment procedures for fluency disorders may vary somewhat as a function of the specific diagnosis (e.g., stuttering vs. cluttering) or as a function of specific subcategories (e.g., the presence or absence of neurological pathology). Nevertheless, they follow certain clearly delineated categories. These categories are:

behaviour modification approaches
various "classic" or "traditional" approaches
emotional or affective approaches
supportive approaches, and
the use of mechanical or electronic devices.

Any of the techniques are acceptable as long as the procedures are those readily recognized by the professional community by virtue of: being formally taught in recognized university or college training programs, professional workshops and short courses; or being widely published or otherwise disseminated in scholarly books, journals, or clinical handbooks by authors with recognized professional credentials.

THERAPY APPROACHES

Many of the techniques described below are suitable for group use as well as with individual patients. Group techniques are referred to, where appropriate.

Behavioural Approaches

Within the rubric of "behaviour modification", there are at least four approaches, the first two being generally applicable to all forms of fluency disorders, and the last two more generally aimed at stuttering.

Operant or Instrumental Approaches

This system relies upon the principles of reward and punishment and is aimed at increasing the frequency of desirable behaviour and decreasing the frequency of undesirable behaviour. The postive reinforcement of fluency as a whole (or an aspect of fluency) is attempted by directly rewarding occurrences of the target behaviour. Negative reinforcement of the same behaviour by the removal of noxious stimuli for each occurrence falls into the same category. The punishment of undesirable behaviour is also an operant or instrumental procedure and occurs when noxious stimuli are delivered to each occurrence; or pleasant stimuli are removed or taken away upon each occurrence. A variety of clinical procedures have been developed based upon these four principles and combinations thereof.

Direct Modification with Shaping

This system involves the direct manipulation of parameters known to promote fluency coupled with operant procedures designed to slowly and systematically bring the manipulated parameter to within normal limits. For example, it is well known that most patients diagnosed as stutterers can achieve fluent speech production when producing a very slow rate of speech production coupled with "easy onset" of voicing with protracted vowel production. Several approaches have been developed to establish and stabilize these skills. Once the target skills have been mastered, producing very high levels of fluency (almost 100%), criteria are set up to systematically increase rate production and decrease vowel protraction while maintaining easy onset. Ideally, fluency is retained during these gradual shifts until the slow, prolonged speech is shaped into a final product which is either judged to be normal, an approximation of normal, or as near to either goal as possible.

It is generally agreed that a systematic and rigorous "maintenance program" is required following successful shaping. It is currently a matter of controversy as to whether a maintenance program is to be continued indefinitely.

Although the literature is scant in support, it is generally agreed that the general premise underlying the technique just described is applicable to other types of fluency disorders, especially bradyphemia (speech production far too slow) and tachyphemia (much too fast).

Respondant or Classical Conditioning Approaches

When evidence is thought to exist that episodes of dysfluency are quantitatively and consistently related to specific environmental cues which elicit tension and other negative affective states, techniques have been devised to reduce or eliminate such relationships. Some of the techniques are: deconditioning, counterconditioning, reciprocal inhibition, and systematic desensitization.*

Several sources provide greater detail on the types of procedures listed above.

Combinations of Above Approaches

There will be times when clinicians may judge that various logical combinations of the above described procedures are in order. A few programs have been designed to incorporate such combinations.

Traditional or Classic Approaches

With specific reference to the fluency disorder of stuttering, a good number of therapeutic approaches have been so widely disseminated and used over the years that they have become conceived of as traditional or classic approaches. One of them, the chewing method, while less commonly used than in the past, has been found by some to be effective in dealing with a wide variety of disorders in addition to stuttering. This technique, like the others to be enumerated, shares many features with the behaviour modification approaches already described, except that conception was not within formal learning theory models.

Because of the very well known nature of these approaches, no attempt will be made here to describe each of them. Rather, references can be consulted for such familiar phrases as: pull outs, cancellations, prepatory sets, light contacts, bouncing, voluntary stuttering, fluent stuttering, negative practice, chewed speech, role playing, and many others.

Emotional or Affective Approaches

Many techniques have been designed to accommodate those clinicians who produce evidence, or have views, that the roots of a fluency disorder lie in one form or another of emotional upheaval. Such techniques are designed to cause positive changes in emotional or affective states. They represent almost all forms of psychotherapy and counselling associated with fluency disorders. As with all of the approaches to fluency disorders, it is reiterated here that appropriate supervised training is crucial and the documentation of "before" and "after" fluency characteristics is crucial.

Supportive Approaches

Various approaches have been designed to promote positive changes in the patient through counselling with parents, relatives, friends, employers, etc. In some situations, supportive techniques may be the sole type of intervention. In other situations, supportive techniques may be used in addition to the other approaches described in this section. It is generally agreed that supportive approaches (parent counselling) be seriously considered as a component of any therapy program of young dysfluent children.

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* These terms are defined in the Glossary.

Mechanical or Electrical Devices

Extreme caution should be exercised when contemplating the use of mechanical or electrical devices for the treatment of fluency disorders. They should only be used when there is clear evidence in the literature that their use can be beneficial to the patient.

Examples of the legitimate use of devices for a fluency disorder would include Delayed Auditory Feedback Techniques, a metronome or similar device, to aid in the establishment of paced speech or the use of certain types of monitoring equipment. Innovative or experimental use of devices are governed by the guidelines found in the Canadian Medical Council Report No. 6.

COMMENT ON TREATMENT OF NEUROGENIC SPEECH DISORDERS

GENERAL CONSIDERATIONS

Unlike the common therapeutic assumption in many language/speech disorders that the individual has normal potential which can be realized or restored by a treatment program, the neurogenic speech disorders of dysarthria or dyspraxia, by definition, require an assumption of limitation of function and compensation for such limitation.

The primary goal of treatment in all dysarthrias is to assume that the subject's communication attempts are understood. This may be accomplished by improving intelligibility or by supplying an alternative form of communication. Improving intelligibility requires two levels of treatment. The first is to assure that the residual movements are performed at their maximum level and the second is to teach compensatory patterns.

Improving residual levels requires exercises to increase strength, range of motion and accuracy of movement. These activities are usually carried out with the active participation of a physiotherapist and/or occupational therapist. The training of compensatory movements takes place when it is known what movements can be performed. Both activities require hours of drill. The practice sessions may be carried out away from the clinic and require the training of family members or some other support personnel.

APRAXIA OF SPEECH

Certain distinctions in apraxia of speech must be made in regards to the factor of age. Certainly, the adult with an intact linguistic and phonologic competence prior to a neurological lesion presents a different clinical picture for remediation than does a child who presents with the condition of developmental apraxia of speech.

Most expert opinion in regards to therapeutic management of apraxia of speech appears to find consensus on the point that a primary strategy is to directly approach the re-learning of articulation. Begin with initiating vocalization and syllable sequences and continue in graduated steps of difficulty through phonemic practice and drill. In association with this aspect of therapy, it is often recommended that the speaker be assisted in the process of self monitoring of speech performance. In addition, since both the adult and the child with apraxia of speech demonstrate considerable difficulty in the sequencing of motor control for speech performance, attention to phonemic competence in monosyllable utterance needs to be extended to careful practising of syllable sequences with attention also paid to intonation and stress patterns in order to improve the intelligibility and naturalness of the resulting speech performance.

AUGMENTATIVE OR ALTERNATE FORMS OF COMMUNICATION

GENERAL CONSIDERATIONS FOR TREATMENT

There is not full agreement among professionals about the wisdom of developing an alternate communication system before every attempt has been made to develop oral skills. However, much of the recent research would suggest (Schiefelbusch 1980, Silverman 1980) that the development of a communication orientation is desirable from the early stages. In a "communication" environment, oral speech becomes just one of the many facets of communication, and reduces the possibility of having the lack of acquisition of oral competence labelled as "failure".

Augmentative communication systems can be used in conjunction with traditional articulation and language therapy, and may be used as a short term aid until oral intelligibility is achieved. Indeed in many instances the use of an augmentative system has been seen to facilitate the acquisition of improved intelligibility. In such instances the augmentative system may be gradually phased out as intelligibility improves.

SYSTEMS AVAILABLE

There are a number of systems readily available for use with non-speech individuals.

1) Signing and gestural systems

These communication strategies are described in Unit C: (Re)habilitation of the Hearing Impaired.

2) Symbol systems

A number of symbol systems have been developed to bridge the gap between picture systems and the use of traditional orthography.

a) Blissymbolics

Blissymbolics is a graphic non-alphabet communication system which is semantically based. The system uses pictographic, ideographic and some arbitrary components which can be combined to refer to concepts rather than specific word equivalents.

b) Rebus

The rebus system uses ideographic symbols in order to develop prereading skills.

c) Other symbol systems

Other systems have been developed inlcuding Non-SLIP and PIC. The literature has not yet shown these systems to be as effective as the more frequently used Blissymbolics and rebus.

3) Pictoral and traditional orthography

There are a number of picture and word/letter communication boards which are commercially available. However, the specific configuration of the communicaton board and the complexity of the vocabulary usually needs to be custom designed for each individual. This is true whether picture, symbol or word boards are being designed.

Aids Available

In addition to the traditional communication board, there are a number of mechanical and electronic aids which are commercially available. Such aids might be considered to facilitate individuals who are unable to indicate choice by direct selection (e.g. pointing); or if an independent aid is desired wherein the user can compile a complete message prior to seeking the listener's attention. There is a wide variety of communication aids which have some type of printed output (LED displays, television displays, typewriter controllers, built-in strip printers) and/or a speech output (either synthesized or recorded speech).

Scanning

The elements of the message, be it pictures, symbols, words or phrases, are presented one at a time to the individual. The individual indicates a choice by a prearranged signal. Mechanical scanning aids require the continuous presence of the listener. Some of the electronic scanning aids (e.g. the Zygo 100) permit the user to build up messages and store them in the unit's memory for later complete playback to the listener, or provide print output (e.g. the Express 1).

Encoding

Encoding permits the individual with limited range of motion to convey messages through prearranged code signals. The code is either memorized or displayed as a reference for both parties as they communicate. Choice may be indicated either through direct selection or by using a scanning technique. Examples of aids which use an encoding technique are the HandiVoice 120 and the Form-a-Phrase without the lapboard.

Direct Selection

This technique requires that the individual point directly to each element of the message. The method of pointing may be via finger, fist, toe, eye, head pointer, light beam, magnet - whatever access system can be developed over which the individual has adequate motor control. The majority of aids available use the direct selection technique (e.g. HandiVoice 110, Canon Communicator).

No attempt is made in this section of the document to deal with aids such as voice amplifiers or environmental aids for the hearing impaired.

TRAINING AND FOLLOWUP

Training in the use of the system may be long term if the client is a child who is in the process of acquiring language. Conversely, if the individual already possesses mature, intact language mastery, then the training may take very little time once the mechanics of the system have been explained. In all instances, the emphasis in training should be to maximize functional message transmission, and the generation of spontaneous utterances.

With those individuals whose cognitive processes are at a very low level, training may need to start at the point of teaching cause and effect relationships, leading to the development of strategies to indicate choice selection. Some interesting developments are evolving through the adaptation of battery-operated toys that function by depressing a simple switch (pedal switches, grasp/release switches, etc.). Enabling the individual to experience the ability to physically control part of his environment may be a first step towards developing communication. Mastery of using such a switch may also be the first step towards accessing environmental aids such as electric wheelchairs and computers.

Seldom will one system be adequate to cover all the communication requirements of the individual. Nor will one system, or a group of aids, be able to meet the needs of the individual as effectively as the natural system of communication. Consequently the continuing goal must be to make the system as functional as possible. It is strongly recommended that a "back-up" system be readily available for those occasions when the equipment needs to be repaired, or where the particular circumstances make its use impractical.

It is helpful to include an "instruction block" on communication boards and devices which explain to the new listener the type of communication strategies employed by the individual. Demonstration of effective use of the communication device to everyone who has contact with the individual will increase the probability of its being used in a functional manner. It is imperative that someone in the individual's immediate environment is identified to facilitate day to day training in its use in functional communication situations.

Even when the patient is able to demonstrate optimal use of the system, its use should be reviewed frequently. Changes in the individual's environment or abilities imply a necessity to review the aids in use to make adaptations or additions to them. Continuing advances in technology also open up avenues to previously inaccessible individuals, or may improve the range of responses available to the individual. Regular reviews also ensure that any equipment currently being used is kept in good working order. Long term followup is essential with this population.

Further resource materials are available - see Selected Bibliography for Unit A: Lloyd, 1976; McDonald, 1980; Schiefelbusch, 1980; Silverman, 1980; Silverman et al. 1978; Vanderheiden, 1978.

In addition, Communication Outlook Newsletter may be obtained from Artificial Language Laboratory, Computer Science Department, Michigan State University, East Lansing. M148824.

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GLOSSARY OF TERMS USED IN UNIT A:

LANGUAGE-SPEECH PATHOLOGY

For the purposes of its deliberations the Expert Group defined the following terms associated with quality of care assessment as they would apply to speech pathology.

AERODYNAMIC	Pressures and flows in the exhaled air stream generated by the process of speech articulation.
AFFECTIVE	An individual's degree of emotional state as interpreted by his or her behaviour, or self report.
BEHAVIOUR MODIFICATION	Techniques derived from learning theory, designed to change the frequency, magnitude or quality of overt or measureable behaviour.
BRADYPHEMIA	A fluency disorder characterized by a very slow and laboured rate of speech production (antonym - tachyphemia).
CLUTTERING	A fluency disorder characterized by a rapid, uneven rate of speech production, and a jumbling of speech sounds, possibly distinguished from stuttering by the patient's lack of awareness of the problem, and a short attention span.
COUNTERCONDITIONING	The repeated, massed confrontation of identified cues while at the same time repeatedly confronting cues which are typically associated with fluency or positive affect.
DECONDITIONING	The repeated, massed confrontation of identified cues under controlled conditions (conditions where unpleasant counsequences following dysfluency are absent or significantly reduced).
DYSPHONIA	Difficulty with the phonatory, or voice, production process; restricted herein to those disorders of laryngeal origin.
EVALUATION	Assessment of a communication disorder to determine its nature, severity, prognosis and appropriate treatment.
EXPANSION	Completion of grammatically reduced utterances produced by an individual.
EXPATIATION	Extension of an utterance by adding semantic information in simple or complex syntactic structures (sometimes referred to as modelling).
FLUENCY	The sum total of those interactions of speech variables such as timing, rate, rhythm, phonation initiation and articulatory transitions which contribute to listener perception of a smooth, easy flow of speech (antonym-dysfluency, non-fluency, dysfluency, fluency failure).
HYPERNASALITY	The perceptual identification of excessive nasal resonance.
HYPONASALITY	The perceptual identification of the lack of normal nasal resonance.
IMITATION	Reproduction of an exhibited behaviour, either immediately or in a deferred manner (also sometimes referred to as modelling).

MODELLING	See expatiation and imitation.
OPERANT (Instrumental)	Acquisition or modification of behaviour based upon the principles of reward and punishment.
PHONATORY FREQUENCY	(Also known as fundamental frequency or voice fundamental frequency)- Frequency (Hz) of the vibration rate of the vocal folds as revealed by the period of the complex, periodic acoustic waveform of the voice signal.
PROSODIC TECHNIQUE	A method in which the clinician varies the stress, intonation and rate of the linguistic input in order to attract the child's attention to certain elements of the utterance.
RECIPROCAL INHIBITION	The repeated, massed confrontation of identified cues under conditions which inhibit the typical result of a negative affect state. Such inhibiting states include: deep muscular relaxation, vigorous motor activity, and assertive modes of responding.
RESONANCE	The acoustical properties of the vocal tract which modify the amplitude of the components of the laryngeal signal. Changes in the shape or configuration of the vocal tract alter these properties to cause changes in the amplitude spectrum of the overall acoustic signal.
RESPONDANT (Classical)	The acquisition or modification of behaviour based upon contingulty or Pavlovian principles.
SYSTEMATIC DESENSITIZATION	Any of the deconditioning, counter conditioning, and reciprocal inhibition approaches wherein parameters other than just the frequency of cue confrontation are systemically controlled. One example follows: public speaking with no one present, then with one friend present, then with two present, etc. up to the point where the audience is large and composed of strangers.
SHAPING	A behaviour modification procedure related to operant conditioning where rewards are provided for behaviours that progressively approximate those that are judged to be normal or desirable.
STUTTERING (Stammering)	A fluency disorder mainly characterized by the repeating and/or prolonging of initial sounds or syllables. These behaviours are very frequently also associated with: whole word and phrase repeating; interjection of extraneous sounds, words or phrases; aberrant body or facial movements; and speech specific or general situational avoidance behaviours.
VELOPHARYNGEAL	Reference to the soft palate, and the lateral and posterior pharyngeal muscular systems at the level of the soft palate.
VOICE HYPERFUNCTION	Reference to a voice produced with excessive and unnecessary amounts of muscular and/or respiratory force or effort.

UNIT B

(RE) HABILITATION
OF
THE HEARING IMPAIRED

CHAPTER V: (RE)HABILITATION OF THE HEARING IMPAIRED

Rationale for (Re)habilitation

Hearing impairment may be mild, moderate, severe, profound, or total. It may be congenital, or acquired before or after language is fully mastered; conductive, sensorineural or mixed; stable, progressive or fluctuating; and/or the result of congenital or acquired diseases affecting the ear and its central auditory connections.

The effects of hearing impairment are many and diverse, varying according to the degree of impairment, its nature and cause, age of onset, and level of language acquired prior to the occurrence of the impairment. The effects of hearing impairment are pervasive, longlasting and cumulative.

In the infant, inability or severely reduced ability to hear sounds and speech produces early differences in parent-infant and infant-parent communication; vocalization tends to remain at a rudimentary level; phonetic repertoire is impoverished in comparison to that of normal hearing infants; vocal quality deteriorates in the absence of auditory feedback; comprehension of spoken language fails to develop (or does so only minimally); personal, social, and cognitive skills may be delayed; and cognitive strategies may differ. As the infant enters the second year of life, behaviour problems are frequently observed. In the absence of habilitative services for the child and his family, increasing deviance will appear; the child may cease vocalizing and rely on a primitive system of gestures to communicate his needs. The prospect of normal schooling becomes less with each successive year during which little or no skilled help is made available. Hence, it has long been recognized that there is a need for early identification of children with severe or profound hearing impairment and for provision of habilitative and educational programs.

Those with less severe impairments also require help. The presence of a mild or moderate hearing impairment has a much graver impact when it occurs in infancy or early childhood than in later life. Diminished ability to hear results in reduced exposure to spoken language, delaying language acquisition. The child who enters kindergarten with a mild or moderate loss, or history of such, almost inevitably has a language deficiency, and is therefore at risk of becoming academically and/or emotionally disadvantaged. Such cumulative effects can be minimized by a relatively small habilitative investment during early childhood.

When hearing impairment occurs in adults, the effects are not in the area of language acquisition, but in communication, especially the reception of speech. The immediate impact of a sudden loss of hearing after normal language has developed is psychological in nature. The effect of a slowly progressing hearing impairment, such as is common among senior citizens, is to some extent the same. Difficulty in communication will tend to lead to withdrawal from social interaction and to feelings of loneliness and worthlessness. Depending on the stage of life at which the loss of hearing occurs, the individual's career and life style may be adversely affected. As soon as hearing impairment is detected, the individual and his family should have access to a broad range of rehabilitative services.

Definition of Terms

The term "habilitation" is used to denote the initial development of skills through the application of special therapy or teaching techniques. The term "rehabilitation" implies the redevelopment of skills (diminished or lost through accident or illness), or the substitution of alternative skills.

(Re)habilitation of the hearing impaired involves family counselling, the selection and fitting of personal hearing aids (and other amplification systems), guidance in the use of residual hearing, speechreading, speech, language, communication, and personal-social skills. Additional factors which require consideration but which may be the concern of other professionals include psychological development, the acquisition of cognitive skills, and educational and vocational guidance.

Professionals involved in (Re)habilitation

The nature of hearing impairment and its effects on many different aspects of development necessitate the application of knowledge from such fields as audiology, child development, education, language-speech pathology, linguistics, psychology, counselling, acoustics, electronics, otology, neurophysiology, and genetics. No one professional group (and certainly no one individual) is likely to have sufficient depth of knowledge in all areas. In addition to medical specialists, the three professional groups most intimately concerned with providing (re)habilitation services for hearing impaired individuals are: audiologists, educators of the hearing impaired, and language-speech pathologists. Psychologists, social workers, hearing aid dealers/dispensers, electronics technicians and others, provide important additional services. Active collaboration of several specialists should be sought in devising (re)habilitative programs tailored to individual needs.

The area of (re)habilitation and education of hearing impaired children is controversial and sensitive. There has been continuing discussion regarding which communication method to use; and which profession is best equipped to serve the hearing impaired. In this report, the essentials of a comprehensive program are outlined and it is emphasized that several professional groups have responsibility for (re)habilitation of the hearing impaired. Availability of personnel and willingness to acquire additional professional skills, will determine responsibility.

I. HABILITATION OF HEARING IMPAIRED CHILDREN

a) EVALUATION

Because hearing impairment frequently affects many different aspects of development, evaluation of hearing impaired children should be undertaken by a team of professionals. A comprehensive evaluation for the purposes of diagnosis should include:

1) initial assessment by pediatrician or family physician
2) otolaryngologic examination
3) audiological tests (see Chapter VIII: Pediatric Audiology; Chapter IX: Educational Audiology)
4) communication skills (see Chapter III: Language and Speech Evaluation; and below)
5) ophthalmologic examination
6) selected medical/laboratory tests to help determine etiology
7) developmental (psycho-motor) tests
8) selected referrals to specialists
9) assessment of cognitive abilities
10) assessment of social and emotional adjustment
11) assessment of educational achievement
12) assessment of family characteristics
13) assessment of socio-linguistic factors.

The above assessments should be carried out by appropriately qualified professionals. The audiologist undertakes the assessment of the child's auditory capacities and amplification needs. Communication skills may be evaluated by a language-speech pathologist and/or an educator of hearing impaired children. Educational attainments should be measured by an educator or a psychologist experienced in assessing hearing impaired children.

Following comprehensive assessments of a hearing impaired child, a team conference should be held. Whenever possible, both parents should be present, along with those professionals who were involved in the diagnosis, as well as those who may be involved with the proposed habilitation/education program. Given that the active collaboration of the child's parents is crucial, and that their co-operation is most likely to be achieved when they are fully informed, each diagnostician should be responsible for explaining the results of his investigations.

Professionals should be aware of the likelihood that parents will react with shock, disbelief and grief at the diagnosis of hearing impairment of a permanent nature, even when the loss is defined as mild or moderate.

b) EVALUATION OF COMMUNICATION SKILLS

The general approach to evaluation of the communication skills of hearing impaired children is essentially the same as that recommended in Chapter IV for any individual with a communication disorder, namely:

1) Objective Recording of the Behaviour Status
2) Case History Interview
3) Statement of Procedures and Evaluation
4) Rationale for Evaluation Approach
5) Rationale for Diagnostic Labels Used
6) Rationale for Additional Consultations
7) Prognostic Statement

In Chapter III, 26 different aspects of language, speech and voice are listed for evaluation. Although the majority of these have relevance for hearing impaired children, a separate and detailed evaluation of each aspect will not usually be practical. Further, the special communication needs and competencies of hearing impaired children have led to the development of diagnostic tools for this population. Where such tools are available, their use is recommended. Particular care should be taken in administering tests and in interpreting results obtained from assessment procedures developed for a normally hearing population.

c) HABILITATION

GENERAL GUIDELINES

The habilitation of hearing impaired children is primarily concerned with the development of communication skills which will enable them to participate fully in the lives of their families and communities, to realize their intellectual capacities through education, and permit their entry into satisfying careers.

Habilitation services may be provided for hearing impaired children through special education programs provided for those attending regular classes on a full or part-time basis, for those attending special classes for the hearing impaired in regular schools, and in day or residential schools for the hearing impaired.

Habilitation programs may also be available in community hospitals, university clinics, and private clinics. Short-term residential programs, mobile vans and/or correspondence courses help to serve families living far from urban centres.

General Considerations

1) The initiation of habilitation should not be delayed until a final diagnosis is achieved. As soon as hearing impairment is suspected, parents should be offered some practical suggestions to help develop or maintain communication skills.

2) The active participation of parent(s) is crucial. To help them become competent as critical agents of habilitation, they should be provided with a comprehensive program which includes:

    i) counselling (psychological support) individually and/or in groups;
    ii) guidance in the use of techniques relating to auditory management, the development of communication skills, and the development of age-appropriate social behaviour;
    iii) education concerning the nature of their child's hearing loss and the implications for development, normal processes of speech and language development, communication methodology, and other relevant topics.

3) Auditory management of the child is of primary importance. This comprises both otologic and audiologic management, and includes the selection, fitting and adjustment of hearing aids and other devices. See Chapter VIII Paediatric Audiology and Chapter X Amplification Audiology. An otologic examination at least once a year is essential.

4) A variety of communication systems has evolved over the years, together with a heated controversy about their relative merits. There is no scientific evidence to indicate that there is one "best" approach. When selecting a system, the following factors should be taken into consideration:

    i) the capabilities of the child, chronological age, age of onset, hearing status, visual capacity, vocal and verbal skills, neurological status, intellectual capabilities, manual dexterity, prior training and experience;
    ii) parental preference;
    iii) the linguistic environment of home and school;
    iv) availability of skilled teachers and clinicians.

5) All professionals involved with the family should respect the choice made, and maintain close liaison to ensure that the child and his parents benefit from their joint efforts.

6) Evaluation of progress should be undertaken on a regular basis and modifications of the program made accordingly. The results of all evaluations should be fully discussed with parents.

7) Parents should be involved in the selection of both long and short-term goals and in the techniques and strategies to be utilized.

8) Children suffering from sudden severe or profound hearing loss should receive immediate and intensive help from speech and hearing professionals, in an attempt to prevent rapid deterioration of spoken language, to facilitate the development of new communication strategies (especially speechreading), and to offer psychological support, techniques and information to the child and his parents, and when necessary, to hospital staff.

9) Parents should be made aware of the continuing effects of hearing impairment on the child's development and education. The more severely impaired the child, the more intensive and extended will be his need for habilitation and special education techniques.

10) Children with mild and moderate losses should receive support services on an ongoing basis in order to ensure optimal development of communication and educational potential.

11) Whenever possible, hearing impaired children should be educated along with normal hearing peers, either on a full or part-time basis. Support services must be provided to ensure the child can benefit from such placement.

12) The following are suggested criteria for full-time placement in regular classes:

    i) effective communication skills (or the availability of an interpreter);
    ii) a linguistic level sufficient to handle the educational materials (e.g., textbooks);
    iii) educational skills equivalent to the average member of the intended class;
    iv) intellectual abilities at least equivalent to the average member of the intended class;
    v) age-appropriate social skills;
    vi) chronological age no more than two years greater than that of intended classmates;
    vii) availability of essential support services (e.g., academic tutor, speech and hearing specialist, amplification system, note-taker);
    viii) co-operation of teachers and administrators;
    ix) parental participation and attitude

Inservice workshops on topics relating to hearing impairment and its effects on hearing should be provided for regular class teachers.

THERAPY APPROACHES AND TECHNIQUES

The aspects of treatment of the hearing impaired child which are considered in this document are as follows:

1 Program Orientation
2 Communication Methods
3 Auditory Management
4 Development of Listening Skills/Auditory Training
5 Language Development
6 Development of Speech Skills

1. PROGRAM ORIENTATION

Habilitation programs may be family centered or child centered.

Family Centered Programs

In a family centered program, the professionals aim to provide parents with the support and expertise which will enable them to undertake the day by day habilitation of their hearing impaired child, while not jeopardizing the well being of other family members. It is the preferred approach in early childhood (from birth to about five years) since parents are the most constant, continuing and influential persons in the child's development and because the affective bond between parent and child facilitates the development of interpersonal communication, and hence, language. As mentioned earlier, a comprehensive program includes counselling, guidance in the use of habilitative techniques, and parent education on topics related to hearing impairment.

Child Centered Programs

In a child centered program, the teacher/therapist is directly engaged in teaching the child (though parent collaboration is still viewed as crucial for success). Only when the child has multiple problems and/or when the parents are unwilling or unable to participate appropriately or to the degree necessary for the child, should a child centered approach be initiated, prior to age three years.

2. COMMUNICATION METHODS

Preamble

The most serious consequence of severe and profound hearing impairment in young children is the barrier it imposes on the acquisition of language in both spoken and written forms. In addition to having speech which only family and friends may understand, the average deaf school graduate is barely literate. Failure to improve standards has fueled a long-standing controversy over communication methodology. Parents should be informed about the controversy and encouraged to visit various educational programs.

There are two basic orientations: total communication (simultaneous method) and the oral method. The proponents of total communication favour the teaching of sign language and fingerspelling, but also support the use of hearing aids, speechreading, and speech teaching.

Programs utilizing an oral method give priority to the development of spoken language through maximal use of residual hearing, speechreading and speech teaching, but exclude the use of sign language. Extensive parent involvement is considered essential. A variety of existing methods are described below.

Pure Oral Method

Developed prior to the invention of hearing aids, this method is still used with the totally deaf. Language comprehension is developed by means of speechreading and writing. Speech is taught by means of visual and tactile strategies.

Multisensory/Aural-oral Approach

Vision, hearing and touch are all utilized in the development of spoken language, with vision generally viewed as the primary avenue of learning. The child's visual attention is gained before speaking to him. Language comprehension is developed through routine activities and along normal developmental lines. Direct speech teaching is not begun until about age five. Visual and tactile aids are utilized to supplement audition.

Unisensory (Acoupedic) Approach

This approach focuses on the training of residual hearing without visual cues. Infants are fitted with binaural aids when appropriate. Parents are shown how to train their child to listen, rather than look. Spoken language is developed along normal lines, and natural voice quality and clear speech are fostered. Placement in regular classes is preferred from the preschool years onward. Individual auditory, speech and language sessions are provided once or twice weekly by a qualified professional along with tutoring in academic subjects as required.

Auditory-Oral Approach

This approach has much in common with the acoupedic method. In addition, a systematic program of motor-speech skill development is introduced in infancy to facilitate the emergence of high quality spoken language. Visual and tactile strategies are used to evoke speech sounds in children for whom the particular acoustic cues are not available. Parent participation is crucial.

Cued Speech

This approach utilizes a system of hand cues intended to facilitate language acquisition by assisting a speechreader to identify which of several phonemes having the same lip configuration (e.g., p/b/m) has been spoken. These cues accompany speech and cannot be interpreted in its absence. In this regard, cued speech differs from sign language. Cued speech is used to supplement an oral approach with profoundly hearing impaired children.

Fingerspelling

Fingerspelling involves the use of a manual alphabet in which there is a specific hand configuration for each letter of the alphabet. Thus, a letter-by-letter representation of spoken language is made possible. For a person who is familiar with the language, it is relatively easy to learn to send messages but difficult to receive.

The Rochester Method

The Rochester Method consists of the simultaneous use of speech and fingerspelling (but not signs).

American Sign Language

American Sign Language, also known as ASL or Ameslan, is the native language of many of those born of deaf parents. ASL has its own lexicon and grammar and evolved from a system developed in France. Signs are formed by means of hand configuration, movement, position and orientation, and each sign represents a concept rather than a word. Expressive use of face and body also contribute to meaning. The syntax of ASL is markedly different from that of English, prevents simultaneous communication in the two languages, and creates problems for deaf children learning English. While ASL, with dialectal variations, is used all over North America, it is distinct from British sign language. In Quebec, deaf people of francophone background have their own sign language (Langage des Signes Québecoises - LSQ).

Sign Systems

Various sign systems which attempt to graft a sign lexicon onto English syntax have been created, though in no case is the syntax of English exactly preserved. For a comprehensive treatment of sign language and sign systems, see Wilbur, 1979.

Paget-Gorman Systematic Sign was developed in Britain. It does not use the signs of either British or American systems, but involves pantomimic signs with 21 hand positions and 39 basis signs combined in different ways. Basic signs have been devised for categories such as "food", "person", and "animal". There are also signs to indicate morphological aspects.

Signing Exact English (SEE 2) is an outgrowth of Seeing Essential English (SEE 1) and utilizes many ASL signs but involves many new signs so that English words having similar pronunciation, spelling and/or meaning can be differentiated. Morphological markers have been invented or borrowed.

Manual English uses many ASL signs, supplemented by a considerable amount of fingerspelling. The word order of English is largely followed. Some of the pronouns, contractions, plurals and possessives are the same as those of SEE 2. The treatment of verb tenses and auxiliaries is different. Compound and complex signs also differ.

Signed English was developed for use with preschool children. Many of the signs are those of ASL, or other systems or were invented. There are twelve sign markers which indicate various English structures.

Total Communication

Total Communication involves the use of ASL or one of the above sign systems accompanied by spoken language. Hearing aids, auditory training, speech and speechreading are also included. In this approach the child is exposed to two language systems.

3. AUDITORY MANAGEMENT (see also Chapter IX: Educational Audiology, and Chapter X: Amplification Audiology)

Monitoring Hearing Level

Regular monitoring of the child's hearing level is essential. Any apparent change indicates the need for otologic and audiologic reassessment. Many problems can create additional hearing loss and reduce the effectiveness of habilitation. (e.g. wax accumulation or middle ear effusion). Routine otologic and audiological tests should be carried out every six months with young children.

Hearing Aid Selection

Hearing aids are the most important tools for aural habilitation and care in their selection is therefore crucial. Consultation and collaboration between the professional selecting the aids and the professional responsible for habilitation/education is strongly recommended.

Monitoring of Hearing Aid Performance

Parents should be trained to check the aids on a daily basis. The aids should also be checked immediately prior to commencing individual therapy or teaching and defects remedied or appropriate loaner aids provided. Electro-acoustic measurements should be carried out approximately every three months.

Hearing Aid Use

Full-time use of hearing aids should be established as quickly as possible. A positive attitude on the part of professionals and parents will facilitate this.

Aided Hearing Ability

Parents and teachers should know what speech sounds the child can be expected to hear and at what distances, so that speech and language stimulation/teaching can be carried out within that range. A daily check is recommended.

Special Amplification Systems

Children with severe or profound hearing impairment will generally benefit from special equipment such as an FM system or desk-type auditory training unit (consisting of an amplifier, separate microphone and head-phones).

Microphone Technique

Appropriate microphone technique should be demonstrated to parents and classroom teachers in order to reduce the effects of ambient noise and enhance reception of speech.

Acoustic Environment

Particular attention should be given to providing hearing impaired children with good listening conditions. Teaching and therapy should preferably be undertaken in a room fitted with a carpet and drapes.

Auditory Environment

In order to acquire spoken language, a hearing impaired child requires ample exposure to normal spoken language from both adults and peers within the meaningful contexts of everyday living. Bombardment with sound through the constant use of radio, T.V. or record player is to be avoided. Periods of relative quiet are also essential if the child is to be afforded the opportunity of listening to and exploring his own vocal repertoire.

4. DEVELOPMENT OF LISTENING SKILLS/AUDITORY TRAINING

The above conditions are essential if the hearing impaired child is to have optimal opportunity to utilize his residual hearing. Listening skills may be developed both informally through experience and by a formal training program.

Auditory Experience

Where a broad range of auditory experiences is provided for the child, within the framework of the meaningful contexts of daily living, the following stages may be expected to occur. The greater the extent of hearing loss, the more guided experience will need to be.

a) Awareness/detection of sound, both speech and non-speech: The child should be encouraged to attend to various sounds of interest in his environment and to the voices of family members and reinforced for responding. Parents should be informed of the types of responses to sound which are typical in the early stages of infant development.

b) Recognizing the sound/associating sound and source: This stage will be reached where the child is provided with ample opportunity to hear sounds within his audible range. Infants and young children should be reinforced for localizing or attempting to localize sound sources.

c) Development of specific responses to verbal communication: This involves building appropriate response patterns in the child to verbal requests, and the auditory identification of relevant actions, objects and relations.

d) The hearing impaired child can be helped to comprehend spoken language through increasing his capacity to discriminate the acoustic cues available for its prosodic, phonetic and syntactic aspects, in the context of real life communication.

Auditory Training

A formal program of auditory training may be instituted to further specific goals but should be a supplement rather than an alternative to auditory experience, especially since problems relating to generalization from training sessions are common.

The type of stimuli selected and type of response required should be examined since each may engage different coding/memory processes. Stimuli and response types should be selected according to the child's auditory, articulatory, linguistic, and cognitive capacities, and in keeping with his developmental level. Graduated exercises may focus on prosodic, lexical, phonetic and/or syntactic aspects of spoken language. Responses may be either nonverbal, vocal, or verbal. Presentations should generally be unisensory auditory in nature, utilizing a tape-recorder and headphones or preventing the listener from seeing the speaker's mouth. During familiarization, speechreading may be permitted.

As a general rule, optimal listening conditions should prevail during teaching or therapy sessions involving new or partially known material. Practice under less favorable conditions may also be appropriate.

5. LANGUAGE DEVELOPMENT

a) Native or near native fluency in the target language(s) is required by those interacting with the infant or young child if more than minimal progress is to be made. Thus, parents who are non-native speakers of English, for example, or non-native users of the desired form of sign language, must quickly be helped to develop such skill. The child's teacher or clinician should also possess the relevant skills.

b) The development of spoken language will be facilitated if maximal use of residual hearing is made from infancy. Parents should be shown how to develop listening skills, vocalization (motor-speech skills) and comprehension of spoken language following the normal developmental sequences, in the course of daily routine activities. The greater the hearing loss, the more guided these experiences will need to be and the more extensive one-to-one interaction will be required.

c) The language learner requires continual exposure to the target language during the course of daily activities. Both adult and peer models are desirable. The language learner requires a considerable amount of positive reinforcement for his efforts.

d) Language stimulation procedures may follow a natural approach based on the spontaneous use of language within the context of everyday life and/or may be developed through a structured approach. A variety of strategies has been specially devised for developing and remediating language in hearing impaired children (see Bibliography). Attention should be given to semantic, syntactic, morpho-phonological, and pragmatic aspects of language.

e) A program of language enrichment which includes expansion of vocabulary and elaboration of syntax and communication skills should be provided even to mildly or moderately hearing impaired children in regular schools. The amelioration of spoken language will usually facilitate the acquisition of skills in reading. Tutoring should be provided in reading, spelling, composition, mathematics and other academic subjects as required.

6. DEVELOPMENT OF SPEECH SKILLS

Hearing impairment of any marked degree generally results in faulty speech patterns, and the more severe the impairment the less intelligible speech is likely to be, especially where the loss has been present from infancy or early childhood.

The early identification of hearing impairment and the availability of high quality individual hearing aids, when combined with highly skilled professionals and willing parents, should make it possible for intelligible (or even near-normal) speech to be attained by an increasing number of severely and profoundly hearing impaired children. There are other children for whom initial speech development is not possible, after early identification. These children may require an alternative communication system.

While many of the strategies utilized with normal hearing children can be successfully applied with hearing impaired children, there are many aspects which require special treatment. For a comprehensive program based on both theoretical and practical knowledge, see Ling (1976). Some general considerations are listed below.

General Considerations

a) The hearing impaired child should be encouraged to vocalize extensively from infancy onwards, being reinforced according to his age and interests. In the absence of reinforcement, the quantity of vocalization diminishes, the vocal repertoire becomes restricted to a few sounds, and the later development of intelligible speech is jeopardized. As far as possible, a normal developmental approach should be followed. Speech sounds should be integrated into the communicative system as early as possible.

b) As the child's vocal repertoire and comprehension of spoken language expand, he should be encouraged to make increasingly close approximations to words and phrases using appropriate prosodic features.

c) Where direct teaching/therapy is undertaken, several short sessions per day, interspersed between other activities, are recommended. Involvement of parents and classroom teachers is essential to ensure carryover into communicative situations. Frequent practice is essential if the motor patterns of speech are to become smooth, flexible and easily produced.

d) Knowledge of acoustic phonetics and the child's auditory capacities form the basis for determining which sense modality or combination of modalities is likely to be effective in evoking and maintaining particular aspects of speech.

e) The association of orthographic symbols with isolated consonant sounds, in particular with stops, may result in the development of faulty co-articulation.

f) Hearing impaired individuals who reach late childhood with unintelligible speech are poor candidates for therapy, because of long-established faulty motor movements.

g) Frequent evaluation and the maintenance of cumulative records help to monitor progress and facilitate the transition from one teacher/therapist to another.

Many hearing impaired children have additional pathologies such as cleft palate or cerebral palsy and will require treatment programs adapted to their needs. The collaboration of various professionals is crucial.

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2. REHABILITATION OF HEARING IMPAIRED ADULTS

1. PREAMBLE

The complexity of services offered to hearing impaired adults varies tremendously in different locations throughout Canada. In many centres, services do not extend beyond the provision of audiological assessment, hearing aid selection, and minimal counselling regarding hearing aid use and referral to a speech reading class. This is in contrast to the scope of habilitation services to the pediatric population. The following section describes comprehensive guidelines for assessment and intervention with the adult population, while acknowledging that in many centres funding is not available for the provision of such services. In some instances payment may be provided through the Department of Veterans Affairs or the Workers' Compensation Board. The Canadian Hearing Society and Vocational Rehabilitation programs may fund some services in various provinces. Essentially, budgeting for adult aural rehabilitation services is an emerging area. Improved awareness of potential funding sources, as well as the scope and development of remedial services in adult aural rehabilitation, must be encouraged throughout Canada, if limited funding and services are to improve.

Although limited aural rehabilitation services are available to geriatric patients, this group displays a high incidence of hearing impairment and communication malfunction. Problems exist in several areas. There is difficulty in making the geriatric population aware and accepting of services. In addition, the resources necessary to work in a rehabilitative manner with this population constitutes a large time and manpower commitment. An exciting potential exists in developing aural rehabilitation programs in extended care facilities which could greatly enhance the quality of life and social involvement of a significant number of geriatric patients.

When a severe hearing impairment occurs suddenly, the patient and his family need immediate access to professional assistance. The psychological, social, vocational implications of the hearing loss can cause severe trauma both to the patient's self perception and to family communication. Immediate professional assistance can greatly alleviate the potential trauma, and immediate intervention will assist in maintaining communication skills at a maximum level.

The adult who is prelingually deaf may require extensive and long-term assistance in order to function adequately and competitively in his environment. The full range of (re)habilitation procedures outlined in this chapter may be called into play. It is imperative that the professional working with the adult deaf patient is proficient in the preferred mode of communication or has an interpreter present. As stated earlier all professional groups should take responsibility for using these guidelines, provided that in each instance a case manager has been identified to coordinate evaluation procedures, referrals, and access to community resources.

(Re)habilitation may also benefit those with a hereditory loss of late onset, those with noise induced loss, and those who suffer from tinnitus.

2. EVALUATION

Typically there are several specific communication problems which can be predicted in association with hearing impairment. However, any of the speech, language, voice or fluency problems described in this document may coexist with those problems traditionally anticipated in persons with impaired hearing. Many of the techniques for evaluation outlined in Chapter III may be utilized in assessing the level of functional communication. Evaluation procedures specific to this population are outlined below.

Procedures

(a) Medical Evaluation

The patient should be evaluated by an otolaryngologist to establish the nature of the deafness, to determine medical treatment possibilities and to comment on prognosis.

(b) Audiological Evaluation

An audiological evaluation is essential prior to initiating aural rehabilitation. Baseline data are obtained using amplification audiology procedures outlined in Chapter X. This information would include hearing aid selection, if deemed appropriate.

(c) Communication Skills

Assessment of the person's understanding and use of language should be made, evaluating competence and effectiveness in decoding and generating oral/aural, written, gestural, manual sign and/or finger spelling modes or language. In addition to assessment of the person's language system, it is also necessary to evaluate his vocal characteristics, phonemic competence, fluency characteristics, and listening skills.

Speechreading Ability

Assessment of the person's ability to understand language through the use of visual-only and auditory-visual conditions should be undertaken to provide baseline data regarding the ability to obtain maximum information from close visual attention to the speaker. Various tests are available but these may not be useful in assessing the effectiveness of a total rehabilitation program. The ability to recognize homophenous (visually similar sound) categories, in a variety of listening conditions plus the ability to discriminate among individual phonemes together with discrimination in continuous discourse, should be evaluated. The clinician should confirm the adequacy of vision for speech reading.

Communication Scales

A rating scale may be used to identify the impact of the hearing impairment upon the person's ability to function in day-to-day activities, at home, work and in social situations. These scales should attempt to pinpoint specific problem areas and to identify the person's reactions, and the reactions of significant others, to the impact of the hearing loss. Communication scales are useful when interviewing the patient, but cannot be taken at face value.

(d) Educational/Vocational Aptitudes

Intellectual level and educational experiences, which have a significant impact upon the type of occupation in which the person can realistically engage, should be considered. The evaluation should include consolidated information on the individual's education/vocational/occupational history, including areas of deficiency which might be amenable to remediation. Information should be collected on the individual's current level of performance and ability. The assessment might include tests of aptitude, skills and interests.

(e) Psychological and Social Characteristics

It is important when planning a rehabilitation program to consider information about the person's psychosocial orientation to his environment. Depending upon the stage of life in which the hearing loss occurs and depending upon the rapidity of the onset of the hearing loss, the individual's life style and attitudes may be adversely affected.

3. REHABILITATION

A remedial program should be initiated after consideration of the person's perceptions of need. In attempting to provide rehabilitation to the hearing impaired, whether deaf or hard of hearing, a wide variety of community resources need to be set in motion. To enable the patient to function at optimum level in society, intervention frequently needs to be available over an extended period. Family members should be involved in all aspects of the rehabilitation process. They and the hearing impaired person should be offered information on the nature and effects of the hearing impairment.

(a) Psychological Counselling

Hearing impaired persons might need extensive counselling to accept their hearing impairment, to develop coping strategies, and to take responsibility for their own actions in making specific changes to improve communication. Those whose hearing impairment progresses slowly may deny the existence of a hearing loss and may withdraw from social contacts because of increasing difficulties in communication. Individuals should be helped to identify problem areas and then to explore alternative solutions which may include such strategies as assertiveness training. Group activities, both formal and informal, may be psychologically helpful. Counselling should also be available to family members.

(b) Hearing Aid Use

In order to create an environment for successful use of a hearing aid, areas other than auditory thresholds need to be examined. The potentially successful hearing aid user is one who is self motivated to seek out assistance, and who is realistic about his listening difficulties. The hearing impaired person should be provided with information on the care and use and limitations of hearing aids. (See Chapter X: Amplification Audiology). The individual and family should be counselled regarding potential continuing communication difficulties. The family should be helped to explore modifications in its communication patterns which assist the hearing impaired person.

(c) Listening Skills

Auditory training should be implemented to help the patient recognize sounds auditorily, to help him adjust to the use of amplification, and to improve his tolerance levels. Experiences in understanding speech under different listening conditions should be provided.

(d) Communication

Therapy should be oriented to improve specific deficits in communication (articulation or voice therapy, improvement in language use and/or comprehension, pragmatic aspects of language and family counselling to improve communication awareness). When required, training to develop effective communication through whatever modes are most appropriate (oral/manual), is recommended.

(e) Speechreading

Speechreading (sometimes referred to as lipreading) may be dealt with either from the traditional analytical approach or from the synthetic approach. A combination of the two methods is frequently advantageous. The analytical approach emphasizes the recognition of sound patterns visually, improved listening skills, the awareness of gestural and environmental cues, as well as an increased awareness of facial expressions. The synthetic approach is oriented to the understanding of the general idea of the topic of conversation rather than the identification of each element of the conversation. Therapy may occur in groups or on an individual basis depending on the needs of the patient.

(f) Training in Using Telecommunication Equipment, Alerting and Warning Devices

For those clients whose comprehension and use of oral speech is at a relatively high level, training and experience in using the telephone together with special devices (such as special amplification equipment) should be provided. For those who are unable to effectively use oral speech, training in using telephone-connected equipment (e.g. Visual Ear, Portatel telephone for the deaf,) should be provided. Equipment is available for special warning and alerting situations (e.g. baby-crying indicators, doorbell indicators) which utilize visual and/or tactile systems. Information on equipment may be obtained through local organizations for the deaf and hearing impaired or through organizations such as the Canadian Hearing Society or the Canadian Coordinating Council on Deafness.

(g) Educational/Vocational Counselling

Unemployment and underemployment among severely hearing impaired adults is a serious problem. Remediation and counselling to equip individuals to compete more effectively in the workforce, and to have greater flexibility in social interactions, is recommended. Modification of the acoustic environment of the work setting, and/or the installation of special telecommunication equipment may be of help.

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UNIT C

AUDIOLOGY: LEVELS OF COMPETENCE AND PROCEDURAL GUIDELINES

CHAPTER VI: AREAS OF PRACTICE IN AUDIOLOGY

1. PREAMBLE

In 1975 the majority of audiologists working in Canada were trained outside of this country. By 1979, however, with an increase in the number of programs in Canada offering Masters level training in audiology, there has been a trend toward an increasing number of Canadian audiologists working in Canadian centres. Nevertheless, because the number of audiologists is small compared to the population of the country, there are some special problem areas in the delivery of this specialized health care. Among these is a shortage of adequate services in rural areas. Since an audiology centre usually is equipped with sophisticated instrumentation and large, immovable sound-treated rooms, provision of services to rural areas may be uneconomical, and often impossible. Mobile units offer some excellent temporary relief to the problem; unfortunately however, they are often unable to meet complete programming requirements.

The dispensing of hearing aids is another area of special consideration. Audiologists are professionals trained in hearing aid fitting and dispensing as a part of a comprehensive (re)habilitation program. However, because of the existing shortage in the number of trained professionals, financial constraints, and the demands of a large population requiring service, the provision of amplification devices and services has often been relegated to a secondary role. Further, hearing aid dispensing is not uniform in method, application, or cost across this country; nor are the laws or regulations consistent or effective. It is anticipated that as the number of audiologists in Canada increases, the services now provided by others will be guided and/or supplemented by audiologists.

In point of fact, the field of audiology has grown so rapidly, and to such an extent, that several sub areas of competence and expertise have developed under the title "audiologist". These include:

1) diagnostic audiology
2) pediatric audiology
3) educational audiology
4) amplification audiology
5) industrial audiology.

The reader must understand that these are not mutually exclusive areas of expertise, and that a particular audiologist may enjoy competence in any one, two, or more of the areas presented in Figure 1.

In addition to the body of knowledge specific to each area of practice, there are common factors which apply to all areas. Prevention, for example, is an intricate component of all areas of specialization. The aim of all programs is to ensure that hearing loss is prevented whenever possible and that, where present, its effect minimized through early identification and management. Preventive measures include sensitizing health care, educational and industrial professionals, government authorities and the general public about situations which can lead to hearing loss and about danger signals indicating its presence.

Another important factor which applies to all areas of audiology is counselling. It is understood that in addition to the measurement of hearing, the relationship with the patient and, where applicable, with his/her parents is very important. Counselling includes such topics as an explanation of the evaluation and results, care and use of a hearing aid and hearing conservation procedures. It also takes into account the patient's reaction to his hearing loss and effects of the hearing loss on his/her lifestyle.

2. LEVELS OF COMPETENCE IN AUDIOLOGY: THE CONCENTRIC CIRCLES

DESCRIPTION OF THE CONCENTRIC CIRCLES

In order to facilitate the discussion of clinical guidelines for the purpose of this document, levels of competence have been described in terms of the five areas of expertise already outlined and graphically depicted in Figure 1.

The concentric circles chart was developed to facilitate description of the various areas of audiological practice and the depth to which a particular audiologist may function within these areas. The definition and content of the five major areas outlined has been somewhat arbitrary and there is, to some degree, overlap between areas. Within any one area, however, an audiologist may be equipped to perform tasks of increasing complexity depending upon his/her training and experience. The professional tasks have been assigned a particular complexity level, with the most simple and straightforward on Level I and the most complex on Level IV. He or she could then be described as having a specific competence profile. A well trained general audiologist could be expected to practise at Level II in all five areas. A Level III competence is developed through specialization resulting from further education and experience. For example, an audiologist employed by a school board, may, through additional training and experience give rise to a Level III competence, in educational audiology. Should he/she retain broad service-based interest in the school audiology program then he/she could be expected to rise to Level III in pediatric and amplification audiology as well.

In general terms these levels of competence could be considered as follows:

Level I: Basic technical level. This could be achieved through a technician's training course or on the job supervised training. A person competent to practise at Level I is called an audiometrist and should be supervised by an audiologist or otolaryngologist.

Level II: Basic degree in audiology. The graduate of an audiology school is expected to be competent at this level in all areas. Practice will maintain Level II skills; experience and continuing education may increase competence to Level III.

Level III: Degree in audiology plus specialized knowledge and skills in certain areas.

Level IV: Advanced level of knowledge and skills in one or more of the following areas: consulting, research, teaching, program and policy development.

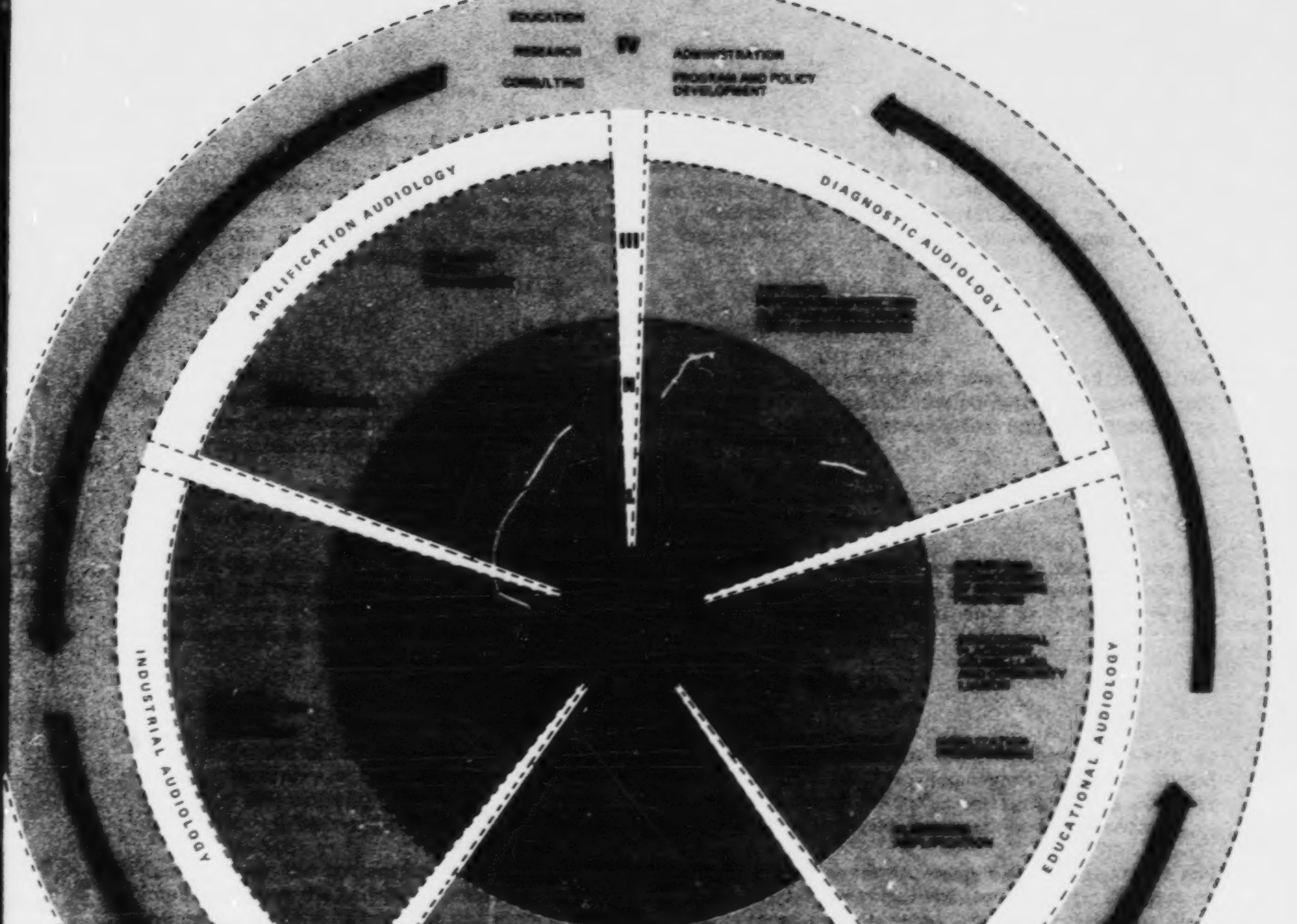
LEVEL
EDUCATION
RESEARCH
CONSULTING
IV
ADMINISTRATION
PROGRAMS AND POLICY DEVELOPMENT
III
II
AMPLIFICATION AUDIOLOGY
DIAGNOSTIC AUDIOLOGY
EDUCATIONAL AUDIOLOGY
PEDIATRIC AUDIOLOGY
INDUSTRIAL AUDIOLOGY

FIGURE 2: LEVELS OF COMPETENCE IN AUDIOLOGY

CHAPTER VII: DIAGNOSTIC AUDIOLOGY

1. LEVELS OF COMPETENCE

The assessment of auditory function was the original raison d'être for the development of audiology as a field of study. Thus, all audiologists, no matter what their area of specialty, are trained in, and should be able to demonstrate total competence in basic audiometry and basic audiology (Levels I and II). Competence in those particular aspects of the assessment of auditory function is the minimum requirement for entering the profession. Without that competence one is not an audiologist. With it alone, one is not an audiologist.

LEVEL I: BASIC AUDIOMETRY

Those performing at the level of basic audiometry are able to demonstrate what is called the "basic battery" of tests to assess auditory function. That group of procedures includes pure-tone air conduction, pure-tone bone conduction (with masking), speech reception threshold, speech discrimination testing, as well as immitance screening.

Competence at this level requires some knowledge of basic anatomy and physiology, diseases of the ear, and disorders of hearing, as well as a familiarity with referral patterns.

Many technicians, aides or nursing staff functioning in physicians' offices and private centres are not completely knowledgeable in all the skills required at Level I. Such individuals should have appropriate on-site supervision by audiologists or otolaryngologists. Individuals functioning at Level I include audiometrists who function in physician's offices, private centres or audiology clinics.

LEVEL II: BASIC AUDIOLOGY

Individuals practicing basic audiology are able to perform all of the functions described in Level I, as well as incorporate the basic battery in a total audiological/diagnostic sequence. Included in the sequence are utilizing interview techniques, taking complete case histories, carrying out a complex diagnostic test battery, counselling, and preparing appropriate reports and accompanying case records.

Case history and patient/family interview techniques are aimed at determining the nature, effect and implications of the hearing problem. Competence in these techniques requires knowledge of: diseases of the ear; disorders of hearing; and associated symptoms, syndromes, and secondary characteristics. Part of the evaluation should include a screening of other communication abilities.

The audiologist functioning at this level is able to select and administer a sequence of complex tests of auditory function designed to differentiate among various types of hearing losses. The individual has basic familiarity with the psychoacoustic and physiological principles behind the procedures. The list of tests includes the basic battery as presented at Level I, as well as other auditory tests which may include: Bekesy screening and diagnostic procedures; tone decay; SISI tests; monaural loudness balance; alternate binaural loudness balance; Stenger tests; the complete immittance battery; reflex decay; and many other procedures which require sophisticated audiometric instrumentation in special sound-treated environments.

At the conclusion of the test sequence, the audiologist is able to provide an audiological diagnosis and interpretation to the referral source; or is able to refer for appropriate treatment. Counselling of the patient/family is expected as a part of the total (re)habilitative program.

A Level II audiologist has the competence to supervise individuals functioning at Level I.

Throughout Canada, the educational training considered necessary for competence at "Level II: Basic Audiology" is a post graduate degree, usually a Master of Science or a Master of Arts. The course work includes academic preparation, laboratory training and practicum experiences under strict supervision.

LEVEL III: ADVANCED PSYCHOACOUSTICAL AND ELECTROPHYSIOLOGICAL TESTS AND PROCEDURES

Considered an expert witness of matters of adjudication, the individual at Level III is at the highest level of clinical training and experience. Competence at this level means a complete understanding of the procedures administered and the principles and rationale behind their usage and development.

Clinical management and supervision of audiologists functioning at Level II should be within the expertise of an individual functioning at this sophisticated level of competence.

Knowledge of the methods of administration of these procedures is mirrored by a knowledge of when and where to do so, under what circumstances, and of the limitations of the procedures and how to interpret the results. Appropriate reports of the findings, including detailed interpretation of results, counselling of patients/families and, wherever necessary, advocacy and action on behalf of the patient (e.g. medical, educational and/or amplificational follow-up and assistance) are a specific responsibility of the audiologist functioning at Level III.

Individuals who can appropriately and successfully involve themselves in specialized areas such as advanced psychoacoustical and electrophysiological tests and procedures are able to differentially evaluate the most complex auditory problems including precochlear, cochlear, retrocochlear, brainstem, mid-brain and cortical lesions, as well as functional hearing loss. The audiologist may function as part of a multidisciplinary diagnostic and management team.

One does not usually obtain competence at Level III without several years of experience following training at graduate school. It is not uncommon for an audiologist skilled at Level III to hold a doctoral degree in audiology.

LEVEL IV: RESEARCH

Audiologists at Level IV may or may not be involved in clinical practice. The areas of emphasis are in learning more about auditory function, development of tests and equipment, and evaluation of instrumentation and procedures. For example, an individual competent at Level IV may be involved in the psychophysical or electrophysiological assessment of a normal person's response to various types of stimuli; the development of amplification services, devices, or systems (e.g. cochlear implants); the design, construction and/or standardization of new test procedures or instrumentation; studies of the origin of certain types of hearing loss; or any one of several different areas of research. Competence here implies complete comprehension of the principles and rationale behind all audiological testing, but not necessarily knowledge of the exact method of presentation of each test. The emphasis is on research rather than on patient-oriented services. The majority of individuals functioning at this level would have received training at the doctoral level.

2. PROCEDURAL GUIDELINES FOR DIAGNOSTIC AUDIOLOGY

Procedure guidelines for the assessment of auditory function vary significantly with the site of the lesion and the diagnostic procedure utilized. To specify test procedures at each level is unwise and imprudent, not only because of the number of tests/procedures involved, the broad scope of the disorders/diseases to be considered, the rapid changes in improvements in diagnostic approach which seem to occur almost daily, but because of the very strong possibility of misinterpretation by the unsophisticated. Wherever recognized standards and procedures are available, they will be included in the discussion. For the balance, the occasional specific procedures and/or the general philosophical approach must suffice. In general, an otoscopic examination is recommended prior to audiometric assessment in order to ensure that the ear canal is free of obstacles.

LEVEL I: BASIC AUDIOMETRY

Procedures in basic audiometry necessary for measuring hearing acuity by pure-tone air conduction and pure-tone bone conduction include the following:

1. Instrumentation, calibration and permissible ambient noise during audiometric testing which shall conform to appropriate standards (CSA Z 107.4-1975 (R 1980)[1]; ANSI S3.6-1969 (R 1973)[2]; ANSI S3.1-1977[3]; ISO 389-1975 (E))[4]; IEC 645-1979[5].

2. Test frequencies which shall include: 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz, for air conduction and when indicated, 125 Hz, 750 Hz, 1500 Hz, 3000 Hz, 6000 and 10000 Hz; and 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz for bone conduction.

3. Manual audiometry which shall conform to ANSI Standard S3.21-1978[6].

4. Hearing thresholds which shall be recorded for rapid retrieval and review. See Appendix B for a recommended standard audiogram format.

5. Mechanisms for referral for medical consultation of those individuals with the following:

   airbone gaps of 15dB at two or more frequencies in either or both ears
   discharging ears
   unilateral hearing loss
   hearing loss of sudden onset
   a chronological age of 16 years or below
   progressive hearing loss.

There are no published guidelines or standards for tests for speech reception threshold or speech discrimination. The American Speech and Hearing Association had developed some suggested standards which were never adopted by that organization. Those suggestions may be seen in Appendix C, and are offered here as a sample, and not as a specifically recommended procedure.

LEVEL II: BASIC AUDIOLOGY

In order to accurately assess human auditory function, certain conditions must be met. Instrumentation, calibration and ambient noise levels must meet or exceed standards defined at Level I. In addition, adequate circumstances for completion of the total audiological/diagnostic sequence may require additional instrumentation and equipment. Based on modifications of a position paper offered by the Ontario Speech and Hearing Association, the following is recommended:

1. Sound treated suite (minimum 2.13 x 2.13 meters)
2. A two channel clinical audiometer
3. A sound field system consisting of appropriate speaker(s) and amplifiers to permit signals of at least 90 dB SPL in the sound field
4. A system for playing recorded test material (2 channel tape recorder)
5. Immittance device with recorder
6. A sound level meter with artificial ear (optional artificial mastoid) (meeting IEC Publication 303 Requirements)[7]

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1. Pure-tone Audiometers for Measurement of Healthy and for Screening
2. Specifications for Audiometers
3. Criteria for Permissable Ambient Noise During Audiometric Testing
4. Acoustics - Standard Reference 2 for the Calibration of Pure-tone Audiometers
5. Audiometers
6. Methods for Manual Pure-tone Threshold Audiometry
7. Publication: Provisional coupler for the Calibration of Earphones use in audiometry.

7. An electroacoustical analysis test system for hearing aids
8. A private room essential for counselling, as well as adequate secretarial and support staff
9. Additional facilities may be needed depending on the size and nature of the population to be served.

Case history information is necessary to determine the nature, effect and implications of the hearing problem. Investigation must include the following areas:

a) Symptomatology

b) Results of other tests and/or medical evaluation - treatment

c) Presence of known precipitative factors for hearing loss (e.g., infections, trauma, iatrogenic causes)

d) Presence of items from high risk register for hearing loss (see section on pediatrics)

e) Patient's response to problems, general attitude and motivation in the testing situation.

Test procedures follow a logical sequence along the auditory pathway. Level I procedures identify deviations in hearing thresholds from normal. Levels II and III procedures contribute, through the administration of more complex procedures to localizing the site of lesion along the auditory pathway. Malingerers and/or those with a functional hearing loss may also be encountered by clinicians operating at this level.

The reader is referred to any of the advanced clinical audiological texts for a detailed description of individual test procedures, their application, and their interpretation.[1,2,3,4]

The majority of the procedures are based on loudness measures, auditory adaptation and/or fatigue, or reduced speech discrimination.

Interpretation and return to the referral source follow all audiological/diagnostic sequences. Included should be some written statement and test results, and an audiological interpretation of their meaning, either on the patient chart or on a separate report, and some direct statement to the patient. An example of a case report may be seen in Appendix A, Chart 1.

Counselling is an important responsibility of the audiologist. The statement to the patient must be carefully structured. Statements regarding the importance of a visit to a physician (or returning to the referring physician), the need for hearing aid or other audiological (re)habilitative procedures, and/or direction to some specific course of action, as required, is essential. The audiologist is responsible for the audiological management of hearing impaired patients for whom medical and/or surgical treatment is not possible.

Guidelines for the plan of treatment of hearing disorders are found in Appendix A, Chart 2. (OHIO Council, 1977) Such a guideline must be modified as changes occur in the testing procedure, and as research affects changes in clinical methods.

LEVEL III: ADVANCED PSYCHOACOUSTICAL AND ELECTROPHYSIOLOGICAL TESTS AND PROCEDURES

1. Advanced psychoacoustical tests which are part of the audiological diagnostic sequence at Level III progress from the assessment of cochlear/brainstem lesions as seen in Level II to the assessment of lesions in the mid-brain up to the cortex. Equipment demands are similar to those of Level II, the major difference being that the systems are more elaborate. Psychoacoustic tests of central function are predicated on evaluating the patient's response to signal distortion, auditory overload and competing information. Examples of distortion are changes in phase, time compression and filtering. The reader is referred to several advanced texts in audiology for further information about specific test protocols.[1,2,4,5]

2. Electrophysiological Tests

Specific procedures for the administration of Electric Response Audiometry include the recording of early components as in electrocochleography and brainstem electric response audiometry, of components of middle latency, and finally of slow components as in cortical audiometry. The selection of these specific procedures will depend on many factors which include information sought, available equipment, the age of the patient, and the physical facility in which the test is administered.

Although there are no standards for Electric Response Audiometry (ERA), it is nevertheless possible to formulate some guidelines for the procedure:

(a) ERA should be utilized only if behavioural testing has failed to provide definitive information or to gain neurological information not otherwise available:

(b) ERA should be administered by adequately trained personnel, utilizing equipment meeting all CSA safety standards;

(c) ERA should not be used alone, but as part of a battery of tests that also includes imittance audiometry and behavioral tests;

(d) the test stimulus whether click, filtered clicks, tonepips alone, or in noise, should be identified;

(e) type and placement of electrodes, and inter-electrode impedance shall be stated;

(f) the results should be interpreted with regard to normal thresholds for the various stimuli;

(g) the state of the patient during the test should be noted, including medications administered for testing purposes (type and dosage);

(h) the report of ERA should include certain basic information with reference to latency, threshold, amplitude and overall wave form morphology; for example in the case of brainstem response, the report should include for each ear:

   i) latency of the Wave V response as a function of intensity
   ii) threshold estimate
   iii) statement of the possible type of associated hearing loss, if any
   iv) measurements of Waves I-V interval

(i) diagnostic centers which make use of ERA should remain aware of developments in this area.

LEVEL IV: RESEARCH

There can be no specific procedural guidelines for research, other than it conform to acceptable scientific standards and address itself to an area of some importance. Clearly, research into new test procedures is vital to diagnostic audiology. Specific information concerning specific behaviour, and specific site of lesion is essential if early detection of disease and early management of all forms of hearing loss are to become a reality.

CHAPTER VIII: PEDIATRIC AUDIOLOGY

1. LEVELS OF COMPETENCE

Pediatric audiology is concerned with the identification, evaluation and management of the hearing-impaired child. The most important aspect of this area is the development and application of methods, for the earliest possible identification and habilitation of the hearing-impaired child.

Distinction between professionals working at Levels I and IV is quite clear, Level I being a screening technician and IV being a research scientist. Distinction between Levels II and III is not as easily discernible. For example, audiologists working in a clinical setting with pre-school and school-age children are those competent to carry out all aspects of Level II and certain aspects of Level III. Clearly, the age and additional handicaps of the patient determine the clinical competence and skills required.

Specific competence subsumed under each of the four levels in pediatric audiology follows.

LEVEL I

COMPETENCE IN SCREENING/BEHAVIOURAL OBSERVATION AUDIOMETRY

Screening of infants and preschool children is included in this section. Screening of the school-age population is dealt with in the Educational Audiology Section. (Chapter IX, Level I)

Individuals competent at Level I shall be able to screen for hearing loss, identify high risk factors and administer appropriate questionnaires.

Personnel carrying out the screening shall receive adequate training in the hearing testing of infants and children, to ensure the highest degree of validity. (see syllabus as described by Northern and Downs in Appendix A, Chart 3). Individuals competent at Level I shall function under the direct supervision of an audiologist or an otolaryngologist.

LEVEL II

Competence at this level requires knowledge of: diseases of the ear; neonatal and other high risk factors; normal speech and language development; and other medical conditions causing developmental delays.

The emphasis in this section is on knowledge and skills to assess the child whether too young or too handicapped to be assessed by the methods described in the section on Diagnostic Audiology, Levels I and II.

The audiologist functioning at this level shall be able to carry out Behavioural Observation Audiometry, and play audiometry; and shall be competent in administering various tests of conditioned response audiometry and immittance audiometry.

Competence at this level requires the ability to take a case history; informally assess a child's communicative, social, developmental levels; administer a diagnostic test battery appropriate to the child's level of functioning; interpret results; make appropriate referrals, decide on proper management; and prepare appropriate reports. The audiologist shall be able to provide an audiological diagnosis and interpretation to the referral source and to provide an interpretation to the parent.

The audiologist at Levels II and III, while part of a multidisciplinary team, shall be competent in providing appropriate counselling and selecting amplification as part of a comprehensive (re) habilitative program (see Amplification Audiology, Level III).

LEVEL III

Individuals competent at Level III will have the knowledge and skills required to differentially evaluate complex auditory problems, both medical and educational. This includes auditory difficulties caused by pre-cochlear, cochlear, retrocochlear, and central or functional problems.

At the conclusion of test sequences, the audiologist shall be able to provide an audiological diagnosis and interpretation to the referral source; counsel; and, when applicable, provide proper amplification as part of a comprehensive management program.

Early detection programming:
Individuals at this level shall be competent in establishing programs to ensure the early identification and follow-up of hearing loss in children (High Risk Registers for example).

LEVEL IV

RESEARCH

The emphasis at this level is on research, not audiological diagnosis or direct patient oriented services.

Competence at this level implies comprehension of the principles and rationale behind all pediatric audiological testing and management but not necessarily knowledge of the exact method of presentation of each test.

Major areas of consideration at Level IV include, for example: the development of improved screening and assessment techniques; epidemiological studies on the incidence of hearing loss in children in Canada; and cost-effectiveness analysis of newborn screening programs.

In addition, Level IV professionals shall be competent to serve as consultants to government agencies with regard to policy formulation and legislation.

2. PROCEDURAL GUIDELINES

The procedures used in pediatric audiology have been described in many text books. It is not the purpose of this document to review all published material but to outline the most recognized and current techniques of pediatric audiology.

LEVEL I

Procedures in this section include screening and observation audiometry.

These procedures are used as a follow-up to the identification of high risk children or are used routinely in nurseries or well baby clinics in conjunction with a detailed questionnaire to the parents.

The list of high risk factors as described in the recent Joint Committee on Infant Hearing Position Statement, 1981, appears in Appendix A, Chart 4.

Post natal high risk factors include meningitis, encephalitis, skull fracture and ototoxic medication.

Screening and Observation Audiometry

Any screening test will have strict criteria with regard to the following:

a) The acoustic stimulus which must be carefully specified as to intensify, frequency, duration, rise and fall time, interstimulus interval and informational content. For older children (5-12 months of age), the stimuli should include some signals centered in the high frequencies (2000-4000 Hz) and some centered in the low frequencies (500-1000 Hz).

b) The infant's response to auditory stimuli which must be differentiated from random behavioural changes during control periods.

c) The scoring of the results.

d) The psycho-physiological states of the infant which must be operationally defined and determined in relation to the test procedure.

e) The physical and physiological factors of the infant's environment which must be described and when possible stabilized.

f) The systematic referral of those children having failed the test.

An example of a suggested protocol for a behavioural hearing screening test can be found in Appendix A, Chart 5 (Gerber and Mencher, 1978).[6]

Appendix A, Chart 6 gives an example of a suggested protocol for the evaluation of hearing in 5 to 12 month old infants. An additional example for screening children from birth to 2 years and from 2 years to 5 years may also be found in the text Hearing in Children, Northern and Downs.[7]

LEVEL II

A comprehensive auditory assessment of a suspect infant should include the following.

1. An extensive Behavioural History by Parental Report

   The diagnosis of a hearing impairment should be done as a team approach. The audiology case history would normally address itself predominantly to the child's auditory and speech development, while information regarding the child's medical, educational, social and psychological status will be provided by the other members of the team.

2. Behavioural Observation Audiometry

   Instrumentation, calibration and permissible ambient noise levels shall conform to appropriate ANSI standards. (See Chapter VII: Diagnostic Audiology).

   As in Level I, the testing procedures require knowledge of the stimuli, response patterns, status of the child at the time of testing, age and developmental level.

   The Auditory Behaviour Index (Northern and Downs, 1974) attempts to classify types of responses and levels of stimuli for different age ranges and can be found in Appendix A, Chart 7.

   For a more detailed description of procedures, the reader is referred to Northern and Downs, 1978 (and 1974).

3. Conditioned Response/Play Audiometry

   In addition to Behavioural Observation Audiometry, the behavioural assessment of hearing in infants can be accomplished in a play situation and through an operant discrimination paradigm.

   Examples of conditioned reinforcement audiometry are Conditioned Orientation Reflex audiometry (COR),[7] and Tangible Reinforcement Operant Conditioning Audiometry (TROCA). (Northern and Downs)[7] and Visual Reinforcement Audiometry (VRA) (Gerber and Mencher[6]).

   Procedure Guidelines are the same as for Behavioral Observation Audiometry but must also include the following:
   a) a definition of the reinforcer
   b) the reinforcement schedule
   c) response envelope

4. Immittance

This procedure is especially well-suited for children, since it is objective, accurate, quick and easy to administer and will give valuable information on young children including those who will not cooperate with conventional audiometric techniques.

Because of the reported incidence of sustained middle ear effusion in new-borns and infants, immitance may in the future play an important role in the assessment of these children.

5. Procedures for referral of children with chronic or sustained middle ear effusion should be as follows:

Any child with apparent middle ear difficulty should be returned to the family physician and a referral to an otolaryngologist, recommended. Further, if a sustained or recurrent problem is diagnosed, educational intervention should be applied in the form of language stimulation programs and/or low level amplification in addition to ongoing medical or surgical treatment.

6. Amplification Management

Procedures for Amplification management are described in Procedure Guidelines for Amplification Audiology Level II.

7. Habilitation Programming

Procedures for habilitation programming are described in Unit B on (Re)habilitation of the Hearing Impaired.

LEVEL III

1. Special Pediatric Assessments

Special pediatric assessments are necessary if behavioural testing is not feasible or yields equivocal results. An example is Electric Response Audiometry.

Electric Response Audiometry has been demonstrated to be a useful and appropriately sensitive tool in the identification and diagnosis of hearing loss in newborns as well as in other difficult to test children.

Procedure Guidelines for Electric Response Audiometry are discussed in Level III of Diagnostic Audiology (Chapter VII).

2. Early Detection Programming

In light of the urgent need to detect hearing impairment as early as possible, procedures in this section should include:

a) the establishment of high risk registers in appropriate institutions;
b) the establishment of hearing screening programs for high risk babies;
c) the training and supervision of individuals carrying out the screening, supervision implying regular on-site observations;
d) the sensitization of health care professionals, parents and the general public with regard to danger signals for hearing loss; and
e) the systematic follow-up of infants suspected of hearing loss.

3. Parent Infant Guidance

It is essential that a training program follow the hearing aid fitting of the pre-lingually hearing impaired child, and that parents be extensively involved in the habilitative process. The program should be individualized and based upon the ongoing assessment of the child's abilities. The following factors should be considered in planning such programs:

a) age of detection
b) age of initial hearing aid fitting
c) age of initial training
d) degree of severity of the hearing loss
e) age of onset of hearing loss
f) suitability of amplification devices
g) hearing aid usage
h) other handicaps
i) auditory, speech and language skills
j) emotional, social, cognitive, fine and gross motor development
k) parental involvement and teaching capabilities
l) availability of suitable programs.

It is essential that the strategies employed be appropriate for the child's needs and developmental level. The goal of any treatment program for the hearing impaired child is the development of communication skills. Equally important is the development of confident, and competent families who are able to provide a stimulating environment for their child.

Parent-infant guidance programs should include regular conferences with all health care professionals involved, in which progress and short and long term plans are discussed with the parents. A very close working liaison with other programs and with the educational system is essential.

For more detail, refer to Unit B: (Re)habilitation of the Hearing Impaired.

LEVEL IV

RESEARCH

There can be no specific procedure guidelines for Level IV pediatric audiology. Any research in this area should conform to currently acceptable scientific standards for research and should address itself to the areas requiring further investigation.

It is obvious that continued research into causes, prevention and methods of early detection of hearing loss is essential. More data are needed on the epidemiology of hearing loss in children and on the cost-effectiveness and accuracy of procedures used for infant screening and for the identification and management of the hearing impaired child.

CONSULTING, POLICY DEVELOPMENT AND ADMINISTRATION

Procedure guidelines in this area are also difficult to define but should address themselves to the problem areas of pediatric audiology; namely, the early identification and management of hearing loss in children.

CHAPTER IX: EDUCATIONAL AUDIOLOGY

1. LEVELS OF COMPETENCE

The educational audiologist must be aware of the needs of the hearing impaired child in the educational setting and the limitations which exist in that environment. Such awareness implies a comprehensive understanding of the educational process and requires a cohesive team approach.

The educational audiologist must be aware of the audiological needs of all children in the educational system and must be capable of designing a hearing health program which will meet these needs.

LEVEL I

Those at level I may be community health nurses, resource room teachers, or volunteers. They shall possess the necessary basic skills and knowledge to conduct pure-tone audiometric screening tests and immitance screening tests where required. They shall work under the supervision of an audiologist.

LEVEL II

The audiologist at Level II is capable of: initiating and supervising school and institutional hearing screening programs; assuring the necessary follow up; providing counselling related to hearing handicap and amplification devices; and establishing a program for monitoring and maintaining amplification devices.

The audiologist at this level shall also be competent at Levels II in amplification audiology and diagnostic audiology (see Chapters X and VII, respectively).

LEVEL III

Audiologists at Level III shall possess the necessary knowledge and skills to participate as members of the educational management team, including input with respect to placement and the overall management of the hearing impaired child with special regard to auditory function. These professionals shall be capable of planning and implementing a (re)habilitation program to fit the needs of individual patients.

Programs must include assistance to parents and teachers, in which an understanding of the hearing loss and its implications are fostered, and an effective learning environment is promoted.

They must have a clear understanding of classroom amplification systems, and be competent to make the most suitable selection.

LEVEL IV

Audiologists functioning at Level IV shall be capable of all the professional activities outlined in Levels I, II, and III above, and in addition, be capable of carrying out research in educational habilitative and rehabilitative programs. This may include competence to conduct epidemiological studies in educational and institutional settings, and to develop programs and curricula.

Further, audiologists functioning at this level shall be competent to advise on school or classroom design in regard to acoustics and their effect on the educational milieu within which the hearing impaired child must function.

2. PROCEDURAL GUIDELINES

Many different programs exist for hearing impaired children. It is not the objective of this document to define an ideal program. Educational and audiological requirements vary greatly, as do individual needs and the resources available. An attempt has been made to outline some of the major aspects of educational audiology required for the design of programs, including the need for a multi-disciplinary approach in the management of the hearing impaired child and the need for an overall hearing health program within the educational setting.

LEVEL I

SCREENING AUDIOMETRY

Procedures at Level I include the following activities.

1. Instrumentation, calibration, permissable ambient noise levels, and screening test procedures should be comparable with the guidelines for Identification Audiometry as seen in Appendix F. Procedures for manual audiometry should conform to ANSI Standards S3.21-1978 (Appendix E).

2. Acoustic immittance may also be incorporated into the screening program in accordance with the guidelines for Acoustic Immittance Screening of Middle-Ear Function (ASHA, 1978) (Appendix D).

3. Testing should be done at regular time intervals and should include follow-up of those children that fail.

   Ideally, every child should be screened annually; however, considering the lack of general funding, the emphasis of identification programs should be placed on the pre-school and early school years. Children should be screened annually in kindergarten and grades 1, 2 and 3. This screening program should include an evaluation of students early in their high school careers and at termination. Retest and referral and follow-up of those children that fail should conform to the Guidelines for Identification Audiometry as seen in Appendix F.

4. Comprehensive records should be kept of all children who have been screened and should be forwarded to the audiologist supervising the program for evaluation and follow-up. Information regarding recommendations for re-screening and the date of testing should also be included.

LEVEL II

1. Supervision of Hearing Screening Programs

   Supervision means regular, on-site observation and review of the entire basic audiometry program. This includes the training of personnel and the maintenance and routine calibration of audiometric equipment utilized in the program; for example.

2. Follow-up

   Children failing the screening program should be evaluated by referral to an audiologist functioning at least at Level II of pediatric or diagnostic audiology. The children failing in the diagnostic centre should be referred for medical consultation. Additional rehabilitative measures should be implemented as required. Where appropriate, the child's hearing should be monitored at regular intervals and, where necessary, referrals should be repeated. Audiological reports should become part of the child's academic record.

3. Basic Counselling

   Counselling at Level II involves a gathering of educational, medical, and audiological test results; and interpreting them to the child's parents, teachers and pertinent school personnel. Teacher education regarding hearing aid and hearing aid usage is a critical counselling role.

   The Level II audiologist should provide the hearing impaired individual and his family, with information relating to relevant community agencies.

4. Basic Management of Amplification Devices

Children requiring amplification devices should be evaluated as described in Amplification Audiology, Level II. Hearing aids and other amplification devices should be selected and evaluated at regular intervals, including the beginning of the school year.

Teachers should be trained with regard to daily listening checks and basic trouble shooting of hearing aids. A sample test is the Ling and Ling[9] 5-sound test. The 5 sounds used are oo, ah, ee, sh, and s. These represent the speech frequencies from the lowest to the highest. Teachers should also be familiar with cord, battery and earmold care, maintenance, and replacement.

LEVEL III

1. Design and Management of Hearing Screening Programs

Practices and Philosophies

Practices and philosophies will vary with respect to the design of the identification program. It is essential, however, that objectives be clearly established and stated before the initiation of the program. Acoustic immitance is strongly recommended. Because of the transitory nature of some middle ear pathologies and because of the inability of most pure-tone screening procedures to identify slight losses, specifically those in the low frequencies, some children may be missed. Procedural decisions regarding the screening program must consider those variables. Some of the major considerations which must be taken into account include:

(a) the population to be served

  1) age
  2) number
  3) pre-disposition to middle ear pathology
  4) testability

(b) access to and co-operation of medical personnel
(c) availability of follow-up and rehabilitation services
(d) economic constraints
(e) co-operation within the educational setting
(f) availability of individuals to carry out the training program
(g) prior training and experience of individuals performing the screening.

2. Educational Placement and Counselling

The extent and type of hearing loss will markedly influence the procedures followed by the audiologist in educational placement and counselling. In the case of a child with a mild to moderate conductive hearing impairment, close liaison should exist among the audiologist, physician and educators.

If a child has a severe sensorineural hearing loss, the audiologist's procedures may differ markedly. In such a case, an educational management team is a far more appropriate approach. An educational management team is ideally composed of an audiologist, educational psychologist, clinical psychologist and/or social worker, speech-language pathologist, teacher of the hearing impaired, special education consultant and a reading consultant. The team should have access to otologists, pediatricians, neurologists, and other medical personnel. Such a team would assess the child's educational potential and suggest appropriate placement, from among those options available.

The audiologist interprets audiological data, explains the benefits derived from amplification, and reviews the limitations and expectations associated with hearing loss.

3. Community Liaison

Public information, public relations, and consumer advocacy remain the responsibility of the audiologist practising at Level III. Knowledge and information concerning hearing impairment should be available to the community at all times.

4. (Re)habilitation Programming (See Unit B: (Re)habilitation of the Hearing Impaired)

5. Classroom Amplification

For additional information see Chapter X: 2. Amplification Audiology, Procedure Guidelines, Level III.

Various forms of amplification systems should be made available to hearing impaired children. It is the audiologist's responsibility to make the decision regarding the type of system required by the child. It is in the child's best interest to have the auditory trainer selected, adjusted, and monitored by the audiologist. Decisions will be based on the following factors in addition to audiological findings:

child's performance in the classroom
structure of classroom activities
teacher's teaching techniques
classroom acoustics
compatibility with other amplification systems within the school.

6. Curriculum Development

Very little information is currently provided to children regarding hearing and the need exists for the development of curricula for both the elementary and secondary school child.

Some topics which should be covered include:

a. anatomy and physiology of the ear
b. hearing protection
c. noise exposure
d. the importance of early diagnosis
e. high risk factors
f. effective referral patterns
g. strategies for effective communication with hearing impaired peers.

LEVEL IV

Procedures at Level IV may chiefly comprise research methods. Any research should conform to currently acceptable scientific standards for research procedures, and should address itself to those areas requiring further investigation.

CHAPTER X: AMPLIFICATION AUDIOLOGY

1. LEVELS OF COMPETENCE

Amplification audiology relates to the selection or fitting of any device which provides acoustic gain (hearing aids, auditory trainers, FM units, etc.) as a (re) habilitative measure for the hearing-impaired. Within the area of amplification audiology falls the responsibility of counselling and educating the recipients (or those responsible for their care) as to the utilization and application of those devices. Historically, there has been some interrelationship between amplification audiology and the hearing aid industry. It is felt that the hearing aid fitter should be capable of providing service to his clients within Level I and certain aspects of Level II in the area of amplification audiology. In some provinces (currently in Quebec and Manitoba), the fitting of hearing aids is regulated by provincial statute.

LEVEL I

BASIC AUDIOMETRY

Those competent in the area of basic audiometry, shall be able to provide accurate measurement of hearing acuity utilizing procedures for testing pure-tone air conduction, pure-tone bone conduction, speech reception thresholds, and speech discrimination, as necessary, for the hearing aid fitting. See Chapter VII Level I: Diagnostic Audiology.

LEVEL II

Those competent at Level II shall be able to assess the individual's auditory status, his communication difficulties and his suitability for amplification. In addition he will be able to determine if a medical referral is indicated.

Competence requires the ability to perform various sound field measurements (e.g. aided versus unaided speech discrimination scores). Additionally, they shall be familiar with calibration procedures within a sound field and with the advantages and limitations of testing within a sound field.

Success with amplification depends not only on audiometric procedures and the hearing aid selection, but also on counselling and educational sessions.

Further, competence includes:

a) the ability to make a proper earmold impression;

b) the understanding of acoustics as it relates to amplification devices;

c) the understanding of the effectiveness of various types of hearing aids (e.g. monaural, binaural, CROS, BICROS);

d) the understanding of the effects of output controls of hearing aids (e.g. tone, compression, maximum power output, and receiver);

e) the proficiency in evaluating amplification devices electro-acoustically utilizing various types of commercially available test equipment, and accurately interpreting the results;

f) the ability to counsel the individual on his hearing loss and on the care and use of the hearing aids;

g) the ability to make appropriate referral judgments.

LEVEL III

Level III can only be carried out by an audiologist. Audiologists competent at Level III shall be able to assess and manage those requiring specialized skills in evaluation and counselling (eg. pediatric, geriatric, multihandicapped).

In addition, competence in the following areas is required.

a) Advanced Patient Management

The audiologist shall be capable of dealing with the population requiring long-term management; interpreting test data from psychologists, educators and medical personnel; and applying this information for the maximum benefit of the patient.

b) Aural (Re) habilitation (in addition see Chapter IX Educational Audiology)

The audiologist shall employ suitable knowledge to develop and maintain the auditory, speech and language skills in the patient.

c) The audiologist shall remain aware of the most recent development in the (re)habilitation of the hearing impaired and incorporate these in the habilitative process.

d) Electro-Acoustic Measurement

Audiologists shall be familiar with standards relating to the electro-acoustic measurement of amplification devices. They shall be competent in both subjective and objective evaluation. They shall be competent in the interpretation of the measurements of amplification devices and must be thoroughly familiar with existing documentation concerning the instruments being evaluated. The standard specified for electro-acoustic measurement of amplification devices shall be ANSI S3.22-1976.

LEVEL IV

Those functioning at Level IV shall have advanced knowledge of acoustics, psycho-acoustics and electronics.

It is their responsibility to contribute to the development of amplification devices and to foster the dissemination of knowledge. The aim is to improve the communication abilies of those requiring amplification devices.

2. PROCEDURAL GUIDELINES

Throughout the years, significant debate has surrounded the topic of hearing aid selection procedures. It is not the purpose of this report to define which procedures are most appropriate; however, it is to ensure a high standard of practice in the area of amplification audiology.

LEVEL I

Procedures at Level I for amplification audiology are identical to those for Level I in Diagnostic Audiology, (Chapter VII). The standardized Level I procedures provide boundaries with regard to methods for personnel working in amplification audiology, operating outside the profession of audiology.

LEVEL II

At Level II the following procedures should be used.

1. An otological examination prior to the hearing aid fitting:

   This is generally desirable and is essential in the case of individuals with:

   - air-bone gaps at two or more frequencies in either or both ears
   - discharging ears
   - unilateral hearing loss
   - hearing loss of sudden onset
   - a chronological age of 16 years and below
   - progressive hearing loss.

2. Case history.

3. Sound field testing:

   Ambient noise level in sound field testing shall conform to ANSI Standard S3.1-1977 and CSA 2107.4-1975 (R 1980).

4. Hearing aid selection and counselling which should include:

   a) the interpretation of audiometric data from Level I;

   b) the assessment of the patient's suitability for amplification;

   c) the selection of appropriate aids;

   d) the evaluation of the patient's aided and unaided performance in sound field;

   e) counselling (on the utilization of the aid; techniques for various listening environments; and introduction to communication aids - eg. telephone, television, and on existing agencies for the hearing impaired);

   f) the subjective evaluation by the patient after a minimum 30 day trial period;

   g) referrals to other members of a multidisciplinary team (see Chapter V: Section 2: Rehabilitation for Hearing Impaired Adults).

LEVEL III

At Level III, advanced patient management should be provided to the following populations: pediatric, geriatric, and those individuals presenting with multiple handicaps. The following procedures should be followed:

a) Children under six years should be directed to a specific centre for an adequate evaluation by an extensive multidisciplinary team, including an otolaryngologist and should be monitored by an audiologist at regular intervals.

b) Children under sixteen years of age shall be evaluated at regular intervals for hearing acuity and hearing aid performance.

c) Adults requiring a rehabilitation program, should receive some or all of the following:

   i auditory training
   ii speech reading training
   iii counselling with regard to: the social and emotional adjustment to the hearing loss; educational or vocational placement; the use and care of the hearing aid; and speech and hearing conservation
   iv regular hearing aid evaluations.

These functions are patient-oriented and should also be sensitive to the needs of the patient's family. A multi-disciplinary approach is desirable because of the many complex needs to be met.

d) Provision shall be made for liaison with other disciplines concerning an individual's ongoing habilitation and education.

LEVEL IV

Procedures at Level IV chiefly comprise research methods. Any research should conform to currently acceptable scientific standards for research procedures, and should address itself to those areas requiring further investigation.

CHAPTER XI: INDUSTRIAL AUDIOLOGY

1. LEVELS OF COMPETENCE FOR INDUSTRIAL AUDIOLOGY

Industrial audiology is concerned with the protection of hearing in noisy surroundings. While federal and provincial statutes set the maximum allowable exposure time for noise for most industries, it is the role of industrial audiology, usually in the face of inadequate legislation, to prevent occupational hearing loss. A commonly used term to describe this role of preventing hearing loss is comprehensive hearing conservation programs. Such programs contain the following elements.

1. Comprehensive noise surveys

   These determine not only what the noise field is in the work place, but also the total sound energy to which each worker's ears are subjected during the work day sometimes referred to as the noise dose. Such measures should allow determination of whether or not a worker is at risk for occupational hearing loss.

2. Education of labour and management about potential risks involved in working in a noisy environment.

3. Modification of equipment at source and administrative controls to reduce risk to workers.

4. Provision of and education in the use of appropriate hearing protection for the noise environment and the type of work.

5. Basic audiometry

   Procedures permit identification of those with significant hearing loss, detection of a significant change in hearing as a consequence of noise exposure and other variables, and assistance in monitoring the effectiveness of the hearing conservation program.

6. Interpretation to industry of existing and proposed health and safety legislation, and the limitations therein.

7. Interpretation of compensation legislation to management and labour.

LEVEL I

Competence at Level I requires the ability to establish valid and reliable pure tone air conduction thresholds utilizing either manual or automatic instrumentation, and to monitor threshold shifts over time. Such testing may be carried out by technically trained staff, e.g. industrial nurses or safety supervisors, with appropriate audiological supervision. Personnel may be adequately trained by successfully completing a three to four day course such as outlined in Appendix A, Chart 8.

Competence at this level requires some knowledge of basic anatomy and physiology, diseases of the ear, and disorders of hearing; as well as the ability to refer all relevant cases to the proper diagnostic/ treatment route.

LEVEL II

Individuals competent at this level are audiologists with knowledge and skills to provide supervision of Level I testers, industrial audiometry testing, and screening noise surveys; and to recommend appropriate hearing protection.

At Level II the industrial audiologist shall be capable of estimating noise risk. Competence requires knowledge of test instrumentation, ability to carry out measurement procedures, and interpret results.

An industrial audiologist working at Level II is capable of the selection and provision of appropriate hearing protection which involves knowledge of the noise environment, attenuation characteristics of various types of hearing protectors, and ability to provide educational information regarding the benefits of hearing conservation. Provision of hearing protectors may be carried out by industrial nurses or safety supervisory personnel, provided such staff have been trained in how to appropriately select and fit protectors and have advisory industrial audiological consulting services available.

Competence in basic industrial audiology includes knowledge of how to test for pure-tone air and bone conduction thresholds, speech audiometry results, acoustic immittance measurements, and knowledge of test instrumentation, test site and test procedures.

Those persons performing the testing at Level I competence shall be supervised by persons competent at least at Level II in industrial audiology.

LEVEL III

At Level III the industrial audiologist is competent in hearing conservation program management. These programs are initiated to protect the hearing of employees in high risk environments relative to noise exposure. The following expertise is mandatory:

1. competence in carrying out comprehensive noise surveys to determine a particular industry's requirements for the rest of its hearing conservation program;

2. competence in educating management, supervisory personnel and employees in understanding the implications of noise exposure;

3. competence in providing basic knowledge regarding modification at noise source. Such information is valuable as this is the best way to decrease employee noise exposure. Acoustical engineers may be involved in the initial stages of such modifications to ensure adequate sound attenuation at the noise source. Competence in suggesting appropriate administrative controls to reduce risk to employees;

4. competence in providing appropriate hearing protection (see comments under Level II Industrial Audiology);

5. competence in interpreting test information obtained from basic audiometry and, where necessary, recommending changes to reduce the risk factors;

6. competence to interpret to management, existing health and safety legislation related to allowable noise exposure and their limitations as they apply to a particular industry;

7. competence to interpret existing compensation legislation to both labour and management; and

8. competence to estimate the outcome of all these hearing conservation measures.

LEVEL IV

At Level IV industrial audiologists are competent in acoustic and epidemiological research. They may be involved in overall plant planning and management with regard to potential noise environments. Competence at this level subsumes competence at Levels I, II, and III. Those dealing with acoustic research as related to industry shall have at least a basic understanding of architectural acoustics and acoustical engineering.

2. PROCEDURAL GUIDELINES FOR INDUSTRIAL AUDIOLOGY

Many of the procedure guidelines for industrial audiology are, in fact, law. Both federal and provincial legislatures have passed various forms of legislation dealing with occupational health and safety and allowable noise exposure. The relevant federal acts, and those in each province are documented in Appendix A-9. It should be noted here that most industries in the provinces are covered under provincial legislation dealing with occupational health and safety. Such legislation is usually housed in the provincial department of labour. Certain industries (e.g. grain handling elevators) are covered under federal legislation, as are all industries in the Yukon and Northwest Territories. It is important, then, to determine under which legislation a particular industry resides.

The federal government has two occupational noise regulations which cover federal businesses and contracts (Canada Labour Code) and public service departments and agencies (Treasury Board Guidelines).

The Canadian Standards Association has a number of standards for various types of instrumentation utilized in noise measurement and in assessment of auditory acuity. Standards of the Canadian Standards Association and other internationally recognized standards for instrumentation in industrial audiology are available.

There are many specialists who may be part of a hearing conservation program. These include, physicians, health and safety personnel, acousticians, computer specialists, and audiologists who are involved in the prevention, measurement and management of hearing loss.

LEVEL I

BASIC AUDIOMETRY:

1. Instrumentation, calibration and permissible ambient noise for pure-tone threshold audiometry shall conform to appropriate standards (see Chapter VII Diagnostic Audiology).

2. Federally, and in most provinces, neither legislation nor regulations exist specifying those test frequencies which must be included in pure tone air conduction audiometry. In those regions where no regulation exist, the following test frequencies schedule shall be followed: 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz and 6000 Hz. These test frequencies are recommended because they assess auditory acuity over a wide frequency range without results being biased by test site ambient noise levels or other uncontrollable test variables (e.g. low test-retest reliability at 8000 Hertz). Determining degree of compensation in most provinces relies on testing hearing acuity at nearly all of those frequencies recommended herein.

3. Test Procedures:
   The audiometric test procedure is wrought with several variables, any one of which may adversely affect the validity and reliability of the results. Through appropriate tester education and adequate supervision of this aspect of the hearing conservation program, the effect of these variables should be kept to a minimum.

   The procedure for manual audiometry shall conform to ANSI S3.21-1978, "Methods For Manual Pure-Tone Threshold Audiometry".

   The recommended procedure for automatic audiometry is outlined in the "Guide For Industrial Audiometry" of the Worker's Compensation Board of British Columbia, 1981 (see Appendix A, Chart 10).

   The procedure for micro-processor audiometry will depend upon specific instrumentation; however, the actual test sequence and threshold determination protocol used by the instrument is described in Appendix C.

4. Records:
There are a number of medical reasons other than noise exposure that may contribute to acquired hearing loss, including infections, trauma, ototoxicity, metabolic and familial diseases, and presbycusis. In addition, the previous history of noise exposure may be useful. A comprehensive check list of these items should be completed for each subject.

Hearing thresholds obtained using either manual or automatic procedures shall be stored in a format convenient for rapid retrieval and review.

5. Referral
The reason for referral is to ascertain whether a significant deterioration in an employee's hearing thresholds is caused by noise or other factors. If the etiology of the change in hearing is attributed to occupational noise exposure, then appropriate measures must be undertaken to reduce that employee's hazardous noise exposure.

In the absence of applicable provincial referral regulations, the following guidelines shall apply.

> Initial Hearing Tests: Those persons having an average hearing threshold at 500 Hz,1000 Hz, 2000 Hz, and 3000 Hz in excess of 25dB Hearing Level or with a loss greater than 25dB Hearing Level at or above 3000 Hz, shall be referred for medical consultation.
>
> Follow-up Tests: Those persons demonstrating a significant deterioration in hearing acuity shall be referred for medical consultation to determine the cause of the deterioration. What constitutes a significant change has not yet been established. Some programs require only a 10dB deterioration at one frequency in one or both ears for referral while in others a 15dB difference at one frequency or at two consecutive frequencies constitutes a change.
>
> Referral Follow-up: If it is determined by medical consultation that a worker has sustained occupational hearing loss, then the industrial audiologist shall ensure that all appropriate measures are taken to protect said worker from incurring further loss.

LEVEL II

1. Supervision of Level I Testers

Supervision means regular, on-site observation and review of the entire basic audiometry program.

2. Basic Industrial Audiology

Procedural guidelines for this Section are identical to those in Diagnostic Audiology: Level I.

3. Comprehensive Noise Surveys to Estimate Risk to Workers

Equipment and procedures shall conform to appropriate standards (ISO 1999, "Assessment Occupational Noise Exposure for Hearing Conservation Purposes"; ISO 2204, "Guide to the Measurement of Airborne Acoustical Noise and Evaluations of its Effects on Man"; CSA Z107.1-1973; IEC Publication 179A, 1973).

LEVEL III

HEARING CONSERVATION PROGRAM MANAGEMENT

1. Education

Correct presentation of this aspect of a hearing conservation program will help ensure the program's success. Education of management and labour about hearing conservation is perhaps the most important feature of a hearing conservation program. With it, employer and employee compliance with all the other aspects of the total hearing conservation program will be more easily realized.

Minimally the following topics should be included in any hearing conservation educational program:

a) effects of noise on man: physical, physiological, psychological and social;

b) provision of noise survey results for work site; and

c) provision of information on hearing protection.

2. Comprehensive Noise Surveys to Estimate Risk to Workers.

Equipment and procedures shall conform to appropriate standards (ISO 1999, "Assessment of Occupational Noise Exposure for Hearing Conservation Purposes"; ISO 2204, "Guide to the Measurement of Airborne Acoustical Noise and Evaluation of its Effects on Man"; CSA Z107.1-1973; IEC Publication 179A, 1973).

3. Modification at Noise Source

4. Administrative Controls

For those employees for whom it is not possible to modify noise at its source, it is beneficial to reorganize the employee's work schedule so as to reduce the noise dose to levels that would not be hazardous.

5. Appropriate Hearing Protection

The industrial audiologist must be aware of the various types of personal hearing protection and their limitations. Where personal protection is provided by an employer and used by a worker, the protection shall be appropriate for the work conditions and for the type and sound levels of noise to which a worker is exposed and shall meet or exceed requirements set out in CSA Z94.2-1974.

LEVEL IV

Procedures at Level IV chiefly comprise research methods. Any such research should conform to currently acceptable scientific standards for research procedures, and should address itself to those areas requiring further investigation.

REFERENCES FOR UNIT C: AUDIOLOGY

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APPENDIX A

Charts 1-10

CHART 1. SUGGESTED FORMAT FOR AUDIOLOGY CASE REPORTS

Patient's Name
Address
Date of Birth
Parents (if applicable)
Chart number
Referral Source

I. Related Information

This includes the information obtained from the referral source, the nature of the problem as described by the patient or parent, a summary of previous test results if applicable and any other pertinent data. Generally, one paragraph is sufficient to summarize this information.

II. Evaluation/Examination

This section outlines the procedures which were administered and describes the results obtained in an objective manner (eg. description of the audiogram, test scores, etc.).

III. Impressions

This section refers to the Audiological Diagnosis which was arrived at after considering all test results (eg. the results of the audiological evaluation on this child, indicate a moderate bilateral sensori-neural hearing loss, sufficient in degree to interfere with speech and language development).

IV. Recommendations

The recommendations which will stem directly from the audiological diagnosis and impression will describe the plans for the individual patient, if applicable (eg. it is therefore recommended that this child be seen for a hearing aid selection and that he be enrolled in a habilitation program.).

Official Signature

CHART 2. GUIDELINES FOR THE PLAN OF TREATMENT OF HEARING DISORDER (as adapted from Ohio Council Document, 1977)

I Communication Disorder: Although more than one type of communication disorder may be present, the major disorder is used for classification purposes.

II Medical diagnosis, if any, to which the communication disorder is related.

III Diagnostic Evaluation for communication disorder should, whenever possible include the following components, although it is understood that some areas included may not be as fully explored as would be desired due to the patient's age, condition, etc.

A. Identification Information

B. Reason for Referral

C. Background Information

1. Case History Form
2. Interview
3. Accompanying Records

D. Examination/Assessment (Adult/Child - adapt procedures as necessary).

1. General impression of client including general impression of voice quality, nasal resonance, receptive and expressive language including lip reading, articulation, psychological status, gross motor abilities, visual and auditory responsiveness.
2. Otoscopic examination
3. Pure- tone air conduction threshold hearing test
4. Pure-tone bone conduction threshold hearing test/immitance
5. Weber/Rinne
6. Speech Reception Threshold (SRT)
7. Speech Discrimination (SD)
8. Most Comfortable Loudness (MCL) level
9. Uncomfortable Loudness (UCL) level
10. Special auditory tests if indicated

    a- Bekesy screening, continuous sweep frequency
    b- Bekesy, diagnostic, continuous/interrupted sweep frequency
    c- Tone decay
    d- Short Increment Sensitivity Index (SISI)
    e- Monaural Loudness Balance (MLB)
    f- Alternate Binaural Loudness Balance (ABLB)
    g- Filtered Speech Tests
    h- Staggered Spondaic Word (SSW) test
    i- Synthetic Sentence Identification (SSI)
    j- Sensori-neural Acuity Level (SAL)
    k- Stenger test, Pure-Tone
    l- Stenger test, speech
    m- Lombard test
    n- Swinging story test
    o- Delayed Auditory Feedback (DAF)
    p- Electric Response Audiometry (ERA)

11. Evaluation of amplification, if indicated

    a- Comparison of aided and unaided results of:

        i- frequency specific thresholds
        ii- speech awareness and reception thresholds, discrimination
        iii- loudness, most comfortable and most uncomfortable loudness

    b- Analysis of electroacoustical characteristics of amplification devices

    c- Patient's subjective evaluation of amplification device(s), if applicable.

E. Impressions

1. Severity, best ear, (adapted from Katz, 1972)

a-	Within normal limits*	0-25	dB (ANSI-1969)
b-	Mild	25-40	dB
c-	Moderate	40-55	dB
d-	Moderately severe	55-70	dB
e-	Severe	70-90	dB
f-	Profound	90	dB plus

2. Etiologic factors, if identified

3. Prognosis

---

* Although these are the recognized limits of normality, the Group feels that in some cases a level of 25dB may be educationally handicapping and an upper limit of 15dB may be more appropriate, particularly with the pediatric population.

CHART 3: RECOMMENDED SYLLABUS FOR TRAINING COURSE FOR OBSERVERS*

1 hour	Orientation and rationale for screening Movies: "Not Cleared for Hearing" (Downs, 1965) and "Auditory Screening of Infants" (Downs, 1971b)
1 hour	Demonstration of techniques Test for sleep state Responses: Movie - "Auditory Responses of Newborns" (Downs, 1971) Instruments Specification of arousal response
2 hours	Practicum in nursery Measuring sound level in quiet room Demonstration of 90 dB sound level signal and responses of infants
2 hours	Logistics and mechanics Standard forms to be used Recording of light or deep state of sleep Checking batteries and calibration Ground rules of nursery: orientation of how to behave, scrub, etc. Becoming familiar with charts and how to read them High risk identification Questionnaire: written and oral Visually observed high risk categories: cleft lip or palate, and malformed ears. Other high risk categories from chart
2 hours	Screening in office and well-baby clinic Films: State of Maryland ("Auditory Screening for Infants," 1959) and State of Nebraska ("Auditory Screening of Infants) (Downs, 1971b) Questionnaire: written and oral Demonstrations
8 hours	Practicum 4 hours in newborn nursery 4 hours in well-baby clinic Two weeks of supervised practice in newborn nursery and well-baby clinic.

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* modified from Northern and Downs.[7]

JOINT COMMITTEE ON INFANT HEARING

POSITION STATEMENT 1981*

Early detection of hearing impairment in the affected infant is important for medical treatment and subsequent educational intervention to assure development of communication skills.

In 1972 the Joint Committee on Infant Hearing Screening recommended screening all newborns by means of five criteria to identify infants At Risk for hearing impairment and suggested follow-up audiological evaluation of these infants until accurate assessments of hearing could be made. Since the incidence of moderate to profound hearing loss in the At Risk infant group is 2.5% - 5.0%, audiologic testing of this group is warranted. Acoustic testing of all newborn infants has a high incidence of false positive and false negative results and is not universally recommended at the present time.

Recent research suggests the need for expansion and clarification of the 1972 criteria. This 1981 statement expands the Risk Criteria and makes recommendations for the evaluation and treatment of the hearing impaired infant.

I. IDENTIFICATION

A. Risk Criteria

Factors that identify those infants who are AT Risk for having hearing impairment include the following:

1. A family history of childhood hearing impairment.
2. Congenital perinatal infection (e.g. cytomegalovirus, rubella, Herpes, toxoplasmosis, syphilis).
3. Anatomic malformations involving the head or neck (e.g., dysmorphic appearance including syndromal and non-syndromal abnormalities, overt or submucous cleft plate, morphologic abnormalities of the pinna).
4. Birthweight less than 1500 grams.
5. Hyperbilirubinemia at level exceeding indications for exchange transfusion.
6. Bacterial meningitis, especially H. influenzae.
7. Severe asphyxia which may include infants with Apgar scores of 0-3 or who fail to institute spontaneous respiration by 10 min. and those with hypotonia persisting to 2 hours of age.

B. SCREENING PROCEDURE

The hearing of infants who manifest any item on the list of Risk Criteria should be screened under supervision of an audiologist, if possible prior to hospital discharge, preferably by three months of age but not later than six months of age. The initial screening should include the observation of behavioral or electrophysiological response to sound.** If consistent electrophysiological or behavioral responses are detected at appropriate sound levels, then the screening process will be considered complete except in those cases where there is a probability of a progressive hearing loss, e.g., family history of delayed onset, degenerative disease, or intra-uterine infections. If results of an initial screening of an infant manifesting any Risk Criteria are equivocal, then the infant should be referred for diagnostic testing.

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* Passed by ASHA, November 21, 1981.

** The Committee has no recommendations at this time regarding any specific device.

II. DIAGNOSIS FOR INFANTS FAILING SCREENING

A. Diagnostic evaluation of an infant under six months of age include:

1. General physical examination and history including:
    - a. Examination of the head and neck
    - b. Otoscopy and otomicrosopy
    - c. Identification of relevant physical abnormalities
    - d. Laboratory tests such as urinalysis and diagnostic tests for perinatal infections.
2. Comprehensive audiological evaluation:
    - 1. Behavioral history
    - b. Behavioral observation audiometry
    - c. Testing of auditory evoked potentials if indicated.

B. After the age of six months the following are also recommended:

1. Communication skills evaluation
2. Acoustic immittance measurements
3. Selected tests of development

III. MANAGEMENT OF THE HEARING IMPAIRED INFANT

Habilitation of the hearing impaired infant may begin while the diagnostic evaluation is in process. The Committee recommends however, that whenever possible, the diagnostic process should be completed and habilitation begun by the age of six months. Services to the hearing impaired infant under six months of age include:

A. Medical Management

1. Reevaluation
2. Treatment
3. Genetic evaluation and counselling when indicated

B. Audiologic Management

1. Ongoing audiological assessment
2. Selection of hearing aid(s)
3. Family counselling

C. Psycho Educational Management

1. Formulation of an individualized educational plan
2. Information about the implications of hearing impairment

After the age of six months, the hearing impaired infant becomes easier to manage in a habilitation plan but she/he will require the services listed above.

REFERENCES

Early Intervention

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Greenstein, J.M., Greenstein, B.B., McConville, K., and L. Stellini, Mother-infant Communication and Language Acquisition in Deaf Infants. New York: Lexington School for the Deaf, 1976.

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Simmons, F.B., Diagnosis and rehabilitation of deaf newborns: part II, ASHA: 22, 7, 475-479, 1980.

Evoked Potential Audiometry

Despland, P. and R. Galambos, The auditory brainstem response is a useful diagnostic tool in the intersive care nursery. Pediat Res 14, 154-158, 1980.

Galambos, C. and R. Galambos, Brainstem evoked response audiometry in newborn hearing screening, Arch Otol, 87, 86-90, 1979.

Starr, A., Amlie, R.N., Martin, W.H. and S. Sanders, Development of auditory function in newborn infants revealed by auditory brainstem potentials. Pediat 60, 831-839, 1977.

CHART 5: SUGGESTED PROTOCOL FOR A BEHAVIOURAL HEARING SCREENING TEST FOR INFANTS AGED 0 TO 2 MONTHS*

1. TEST STIMULUS:	A random noise having a low frequency attenuation of 30 dB or more per octave below 750 Hz; a maximum of 90 dB sound pressure level at the pinna; a rise-decay time of five (5) milliseconds or more; a duration of 0.5 to two (2) seconds; interstimulus interval minimum of fifteen (15) seconds.
2. TEST ENVIRONMENT:	The ambient noise level at the time of the typical test should be measured and reported.
3. PRETEST STATE:	The pre-test behavioral state of an infant is an important determinant in governing the initiation of a response and must be controlled or described in specific terms. This protocol calls for a sleeping infant (eyes closed, no observable body movement for at least fifteen (15) seconds prior to stimulation).
4. INFANT RESPONSE:	Any generalized body movement which involves more than one limb and which is accompanied by some form of eye movement.
5. SCORING CRITERIA:	Controlled by one of two methods: a) Scorer does not know when a stimulus is actually present, or b) Two observers score an infant's responses independent of one another. Furthermore, two (of eight maximum) stimulus responses should be positive to score as a "pass" and a "failure" should be retested at least once (with a cumulative positive response score of more than 20%) before being considered a true test "failure".

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* modified from Gerber and Mencher[6]

CHART 6: SUGGESTED PROTOCOL FOR SCREENING OF HEARING IN INFANTS (AGED 5 to 12 MONTHS)*

Date of Test____________________ Birthdate______________________ Sex________

Surname_______________ First Name__________________ Father's Name____________

Address____

Marks:
Clear Response (+); Delayed Response (D); Doubtful Response (S); No Response (-)

Auditory Screening Tests**

Kind of Examination			Frequency in Hz	Intensity in Db From Distance of 30 cm.	Responses L.E.	Responses R.E.
Test 1						
Localization Response	1.	First rattle	2000-16000	35	____	____
	2.	Second rattle	4000-16000	40	____	____
	3.	Cup, spoon	2000-1000	40	____	____
	4.	Rustling of tissue paper	62.5-8000	40	____	____
Test 2						
Localization and auriculo-palpebral reflexes	1.	Toy drum	64-500	65	____	____
	2.	Rattle	2000-16000	55	____	____
	3.	Rattle	4000-16000	65	____	____
	4.	Whistle	2000	70	____	____
	5.	Trumpet	500-8000	70	____	____

Details on Child's Health***

Has he suffered from ear infection? No ________

Yes (With recurrent discharge) ________

Yes (Without recurrent discharge) ________

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* Based on forms and materials supplied by Feinmesser and Tell, Jerusalem, Israel; and Borkowska-Gaertig and Sobieszczanska-Radoszewska, Warsaw, Poland (Gerber and Mencher[6]).

** Frequency and intensity analysis should be stated for any stimulus.

*** The Group recommends inclusion of questions pertaining to the newborn's high risk factors for hearing loss. (see Appendix A, Chart 4)

Has he suffered from:
- a) Meningitis or Encephalitis?
- b) Other illnesses such as: (C.P., Polyomelitis, Mumps, Measles, etc.)
- c) Was he hospitalized?___ Cause ______________________________
  Place and duration of hospitalization ______________________________
  ____
  Had severe trauma? No _______________ Yes ______________________
  Congenital malformations ______________________________
  Remarks ______________________________

Details on Child's Development

	Yes	No	Remarks
Has good head balance	____	____	________
Sucks and swallows well	____	____	________
Brings hand to mouth	____	____	________
Good relationship to environment	____	____	________
Reacts to noises and voices from the environment	____	____	________
Babbles	____	____	

Summary:
1. Passed
2. Failed
3. To be retested

The test described below may be used in Well Baby Clinics to detect babies whose responses to acoustic stimuli deviate from the normal.

This test is less accurate than an audiometric procedure.

The frequencies of the devices selected for testing the hearing of babies are similar to those of the Audiometer.

Presentation of the acoustic stimuli should be carried out for each ear separately, at the level of the ear, and at the intensities and distances indicated herein.

1. Cellophane paper - delicate crumpling.
2. A cup and teaspoon - a movement of turning the spoon in the cup without knocking at its sides.
3. A rattle - delicate, sharp and short noise.
4. A bell - delicate and short ringing.
5. Spoken voice: - pronouncing the syllable Ps, Ps, Ps, Ps, four times.

The test should be carried out in the quietest room of the Baby-Clinic.

The chair that the mother sits on should be put in the middle of the room, facing away from any windows, at a distance of 1-1/2 to 2 meters from any walls.

The mother should hold the child on her lap with his back leaning against her, and his limbs free of all clothing.

The test should be carried out by two persons -- one producing the sounds behind the back of the baby, and the other observing the responses of the baby from a distance of one meter opposite the baby, but in a diagonal line, so as not to distract the child.

While testing, one should be on guard not to let the child see the movements of the hands or the shadow.

There should be a between stimulus interval of several seconds.

The expected responses:

1. Movement of the head.
2. Blinking of the eyes.
3. Movements of the limbs.
4. Holding of breath.
5. Starting or cessation of crying.
6. Grimacing.

Results to be recorded:

1. If the baby responds clearly and promptly in the manner mentioned above, record "+", which means Clear response.

2. If the baby's response, though clear, is somewhat delayed, then mark "D", which means Delayed response.

3. If the baby's response is doubtful, the letter "S" is to be marked, which means doubtful.

4. No response is to be marked by "-".

The child fails the test when:

1. There is no or doubtful response in both ears to two or more identical stimuli out of 5.

2. No or doubtful response to both rattle and bell or other stimuli in one ear only.

The children who fail the test should be retested in the same manner within a month. (Usually 2 -4 weeks).

3. Failure at the second test requires immediate referral to an Audiology Center.

The testers are requested to fill in accurately all the items of the forms with regard to the "hearing test", and other relevant details and to forward those forms with the referral.

The devices should be carefully handled and put into the appropriate boxes after the test is performed.

Personnel in the Baby Clinic are encouraged to call an Audiology Center any time in regard to any problems arising in connection with the work.

CHART 7: AUDITORY BEHAVIOUR INDEX FOR INFANTS: STIMULUS AND LEVEL OF RESPONSE*

Age	Noisemakers (Approx. SPL)	Warbled Pure Tones (Re: Audiometric Zero)	Speech (Re: Audiometric Zero)	Expected Response	Startle to Speech (RE: Audiometric Zero)
0-6 wk	50-70 dB	78 dB (SD = 6 dB)	40-60 dB	Eye-widening, eye-blink, stirring or arousal from sleep, startle	65 dB
6 wk-4 mo	50-60 dB	70 dB (SD = 10 dB)	47 dB (SD = 2 dB)	Eye-widening, eye-shift, eye-blinking, quieting; beginning rudimentary head turn by 4 mo.	65 dB
4-7 mo	40-50 dB	51 dB (SD = 9 dB)	21 dB (SD = 8 dB)	Head-turn on lateral plane toward sound; listening attitude	65 dB
7-9 mo	30-40 dB	45 dB (SD = 15 dB)	15 dB (SD = 7 dB)	Direct localization of sounds to side, indirectly below ear level	65 dB
9-13 mo	25-35 dB	38 dB (SD = 8 dB)	8 dB (SD = 7 dB)	Direct localization of sounds to side, directly below, ear level, indirectly above ear level	65 dB
13-16 mo	25-30 dB	32 dB (SD = 10 dB)	5 dB (SD = 5 dB)	Direct localization of sound on side, above and below	65 dB
16-21 mo	25 dB	25 dB (SD = 10 dB)	5 dB (SD = 1 dB)	Direct localization of sound on side, above and below	65 dB
21-24 mo	25 dB	26 dB (SD = 10 dB)	3 dB (SD = 10 dB)	Direct localization of sound on side, above and below	65 dB

* Based on Northern and Downs.[7]

CHART 8: INDUSTRIAL AUDIOMETRY AND HEARING CONSERVATION COURSE*

SAMPLE CURRICULUM

Anatomy & Physiology of the Ear

Noise Induced Hearing Loss

Principles of Audiology I & II

The Audiometer

Principles of Audiometry

Audiometric Testing

Audiometric Ethics

Physics of Sound

Measurement and Control of Noise

Hearing Protection

Hearing Conservation Programmes

Compensation

The Law and Employer/Employee Co-operation

Audiometry Laboratories (8 hours)

*Resource Centre for Occupational Health and Safety
Lakehead University
Thunder Bay, Ontario (1982)

CHART 9: LEGISLATION RELATED TO NOISE AND OCCUPATIONAL HEALTH AND SAFETY

FEDERAL

Canada Labour Code

Part IV, R.S.C. 1970, C. L - 1
Canada Noise Control Regulations
S.O.R./71-584 (as amended by S.O.R./73 - 66; 76 - 436)
Mines Regulation Act, (Rule 94)
Coal Mines Regulation Act, 1969, (Rule 15)

PROVINCIAL

Alberta:

Public Health Act 1971 (in effect)
Regulations Respecting the Protection of Workers from the Effects of Noise (Division 29)
Occupational Health and Safety Act (1976)
Noise Regulations
Alberta Regulations 314/81

Contact

Department of Labour
Occupational Health and Safety Division
Occupational Hygiene Branch
2nd Floor, 9820-106 Street
Edmonton, Alberta
T5K 2J6

Phone Number: 403-427-2687

British Columbia:

Workers' Compensation Act 1968

Contact

Workers' Compensation Board of British Columbia
5255 Heather Street
Vancouver, British Columbia
V5Z 3L8

Phone Number: 604-266-0211

Manitoba:

The Workplace Safety and Health Act 1976

Contact

Manitoba Department of Labour
Workplace Safety and Health Division
316 Norquay Building
Winnipeg, Manitoba
R3C 0P8

Phone Number: 204-944-3615

New Brunswick:

Occupational Safety Act 1976

Contact

New Brunswick Department of Labour
Fredericton, New Brunswick

Phone Number: 506-453-2307

Newfoundland:

The Occupational Health and Safety Act, 1978

Contact

Newfoundland Department of Labour
St. Johns, Newfoundland

Phone Number: 709-737-2705

Nova Scotia:

Public Health Act, Chapter 247 of the revised statutes of Nova Scotia, 1967 Industrial Safety Act 1967

Contact

Province of Nova Scotia
Department of Health
Post Office Box 488
Halifax, Nova Scotia
B3J 2R8

Phone Number: 902-424-5660

Ontario:

Occupational Health and Safety Act 1978

Contact

Ontario Ministry of Labour
Industrial Health and Safety Branch
Toronto, Ontario

Phone Number: 416-965-4125

Prince Edward Island:

The Workers' Compensation Act 1974

Contact

The Workers' Compensation Board
Charlottetown, Prince Edward Island

Phone Number: 902-894-8555

Quebec:

Loi sur les Accidents du Travail
(LRQ, C.A.-3; C57; 1979, C.63)
Règlement relatif à la Qualité du
Milieu de Travail
A.C. 3169-79

Contact

Gouvernement du Quebec
Ministere du travail et de la main-d'oeuvre
Service d'inspection du travail et
des lieux publics
425, rue St-Amable
Quebec, Quebec
G1R 4ZI

Phone Number: 418-643-3648

Saskatchewan:

Occupation Health Act 1972

Contact

Saskatchewan Department of Labour
Occupational Health and Safety Division
Regina, Saskatchewan

Phone Number: 306-664-5052

CHART 10: AUTOMATIC AUDIOMETRY TEST PROCEDURE*

A. PRELIMINARIES

The seating arrangement, preliminary questions and placement of headphones for manual audiometry are as outlined on page 3-1 of the British Columbia manual.

B. INSTRUCTIONS

"You will hear a series of faint beeping tones starting in your left ear. Each time you hear the tones, press this button and hold it for as long as you hear. Let it up when the tones are gone. Remember to press when you hear, even if the tones are very faint. I will give you a practice period at the beginning."

C. TEST PROCEDURE

1. Fill out the audiogram card and re-position the table to starting position. On some audiometers the table must be pushed all the way in to the starting position. Other audiometers require the stylus to be pushed as far to the left as possible.

2. Depress the START switch.

3. Place the TABLE switch to HOLD or TRIAL position immediately after activating the start switch. The stylus will run up and down without a left to right movement across the test frequency. Leave the machine in this position until the subject's vertical excursion size is about 10dB. If the tracings are abnormally large or small, the subject should be re-instructed.

4. When the practice session is deemed adequate, release the TRIAL or HOLD button. The actual test will now begin.

   It is important for the technician to watch for abnormalities while the test is being performed.

   When the subject depresses the hand switch, the stylus moves toward the top of the graph; when the subject releases the switch, the stylus makes a mark in the opposite direction. Every response the subject makes, typically about five per frequency for each ear, is automatically recorded.

   The spread from the highest peak to the lowest valley should be between 10dB and 25dB. A smaller spread, eg. about 5dB from the best threshold to the worst at a particular frequency, indicates that the subject has not understood instructions and is trying to keep the tone at one particular loudness level, or that the subject is abnormally sensitive to increases in intensity. A larger spread from peak to valley indicates that the subject again has not fully understood the instructions.

5. A MID-DELAY switch may be manually activated by the technician on some audiometers where the subject shows a severe hearing loss at the last frequency tested in the first ear. This will prevent the other ear from being blasted with a very loud 500 Hz tone when the signal begins again. On some automatics, this feature is built in.

6. Mark reliability.

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* Adapted from:
Industrial Audiometry, Training & Reference Manual, Fourth Edition, Workers' Compensation Board of British Columbia, 1981

D. READING AUTOMATIC AUDIOGRAMS

There are two rules for reading automatic thresholds:

Rule 1: If the thresholds show a normal (10dB) or large (15 - 25dB) vertical excursion across all frequencies, average the peaks to the nearest 5dB then add 5dB. If the peaks appear to be halfway between two 5dB steps, average them to the higher value.

People who give large tracings throughout tend to be reluctant to respond to very soft tones. Thus their results are biased towards showing poorer hearing than they actually have. That is why averaging the peaks is appropriate.

Rule 2: If the audiogram shows large tracings only in the high frequencies a different rule is appropriate. These individuals generally will give a normal 10dB tracing size until they reach 3000 Hz. At this point, the tones will be confused with the constant ringing in their ears and they will be unable to tell when the tone has gone. For this pattern use Rule 1 for the low frequencies and average the valleys and subtract 10dB for the high frequencies.

A single dip should not be confused with an early warning notch. This usually results from an unusually loud noise during the test or a momentary lapse of attention on the part of the subject.

If there are fewer than 5 threshold crossings by the pen during any frequency, the pen colour should be changed and the frequency retested. It is not possible to assign a value to this threshold.

E. PROBLEMS

In the past, it has sometimes been found that the automatic test is more difficult than the manual due to the more complex nature of the test. The validity of the test results depends heavily upon the person understanding the instructions. Any difficulty understanding the language or the concept behind the task may make the results unreliable. It is therefore recommended that you make the instructions very simple and repetitious if necessary; demonstrate the use of the hand switch; have tapes made of the instructions in the prominent dialects or use an interpreter.

F. MICROPROCESSOR TEST PROCEDURE

1. Instructions:

"You will hear a series of three beeping tones. Each time you hear the tones, press this hand switch to indicate that you hear. Remember to press even when the tones are very faint."

2. Automatic Test Procedure: (See the specific manual for your machine for greater detail)

a) Enter date, if desired, on the keyboard.
This date will remain in the machine's memory until the machine is turned off.

b) Enter appropriate subject identification if desired.

c) Select ear you wish to start with. NB: On some models, only the left ear may be tested first in the automatic mode.

d) Press the button to start the test.

e) The machine will begin at 50dB at 1000 Hz in the left ear. It will establish thresholds using the technique described in the chapter on manual audometry. After 1000 Hz the machine tests 500 Hz then retests 1000 Hz again. If the two 1000 Hz thresholds agree within ± 5dB the machine will go on to the higher frequencies and to the second ear.

If they do not agree, the machine will test 500 Hz again then retest 1000 a third time. If there is still no agreement, the machine will sound an alarm to call the technician.

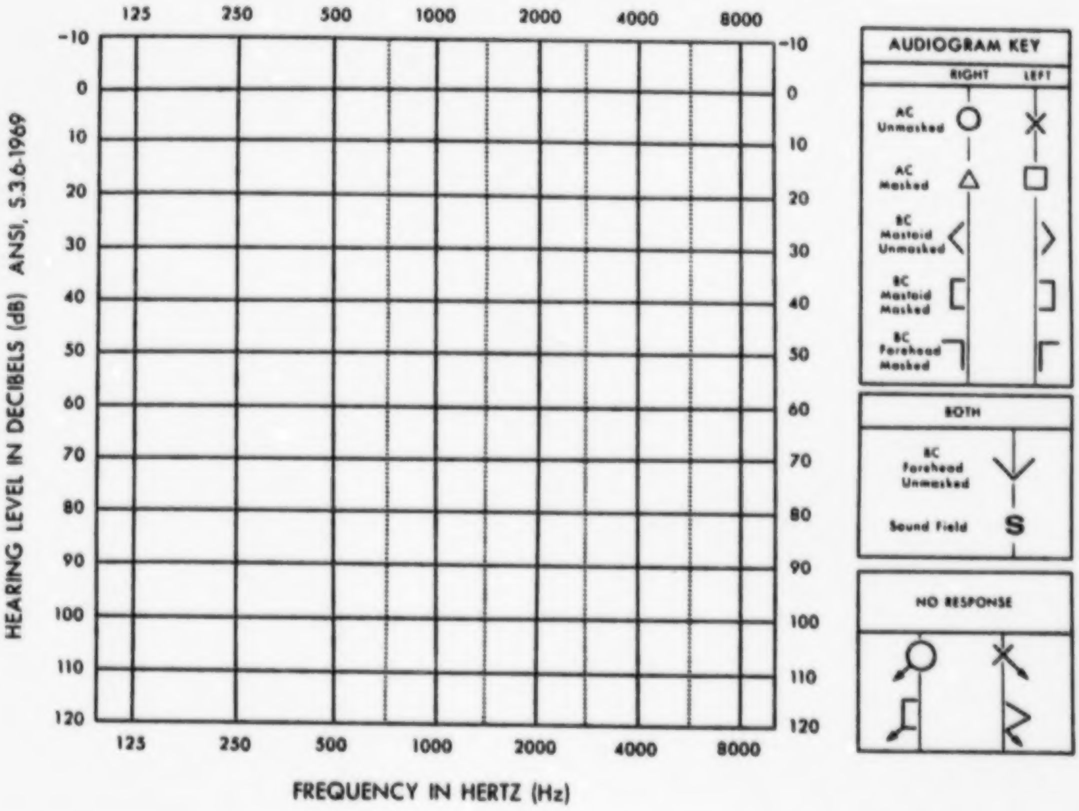
3. Manual Test Procedure:

Some subjects will have to be tested at some or all frequencies using the manual mode. It is very important to avoid giving visual cues that the tone is being presented.

APPENDIX B

APPENDIX B

STANDARD AUDIOGRAM FORMAT



APPENDIX C*

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* The references corresponding to each ASHA Guideline have been omitted. The reader is therefore directed to the original documents of the American Speech-Language-Hearing Association, if more information is required.

GUIDELINES FOR MANUAL PURE-TONE THRESHOLD AUDIOMETRY*

The set of Guidelines for Manual Pure-Tone Threshold Audiometry is the third of a series developed by the Committee on Audiometric Evaluation, under the office of Vice President for Clinical Affairs of the American Speech and Hearing Association (ASHA). The first in the series was the Guidelines for Audiometric Symbols (1974), adopted by ASHA in December 1973. The second was the Guidelines for Identification Audiometry (1975), adopted by the Association in November 1974.

Each of the guidelines presents a recommended set of procedures based on existing practice and research findings. The spirit of these guidelines is not to mandate a single way of accomplishing a clinical process; rather, they suggest standard procedures that, in the final analysis, will benefit the persons we serve. The intention is to improve interclinician and interclinic comparison of data, thereby allowing for a more effective transfer of information.

The ASHA Guidelines for Manual Pure-Tone Threshold Audiometry presents procedures for accomplishing hearing threshold measurement with pure tones that are applicable in a wide variety of settings. Diagnostic pure-tone threshold audiometry, used most often in clinical settings, includes manual air-conduction measurements of octave intervals from 250 Hz (125 Hz under some circumstances) through 8000 Hz plus bone-conduction measurements at octave intervals from 205 Hz through 4000 Hz as needed. Also, when required, masking is used. Monitoring pure-tone threshold audiometry, used most often in industrial settings, includes manual air-conduction measurements at the frequencies of 500, 1000, 2000, 3000, 4000, and 6000 Hz.

SCOPE

Pure-tone threshold audiometry is the measurement of an individual's hearing sensitivity for calibrated pure tones. Two general methods are employed (1) manual audiometry, also referred to as conventional pure-tone audiometry; and (2) discrete-frequency or sweep-frequency testing by automatic audiometry referred to as Bekesy-type audiometry. The guidelines presented in this document relate only to manual pure-tone audiometry.

The historical antecedents of pure-tone audiometry were the classical tuning fork tests. The development of the audiometer made it possible to control signal intensity and duration in ways that were not possible with tuning forks. One cannot assume, however, that calibrated equipment insures that valid measurements are always obtained. Differences among measurement methods may affect validity and reliability in significant ways as pointed out by a number of authors (Hughson and Westlake, 1944; Reger, 1950; Watson and Tolan, 1949; Hirsh, 1952; Carhart and Jerger, 1959; Price, 1971; and Newby, 1972).

These guidelines present a standard set of procedures that will minimize inter-test differences. These guidelines represent a consensus of recommendations found in the literature, with particular emphasis on the suggestions of Carhart and Jerger (1959) and Reger (1950). The American Speech and Hearing Association does not intend to imply that only one method is correct; variations in procedure may be demanded by special clinical problems. For example, special populations such as very young children, severely mentally-retarded persons, severely hearing-impaired persons, uncooperative persons, or neuro logically handicapped persons may require modifications of the guidelines procedures if the audiologist is to develop sufficient information for case management. When variations in procedure are necessary, they should be noted in a manner that allows other testers to understand how thresholds were obtained. The pure-tone guidelines are presented in three sections (1) determination of pure-tone thresholds, (2) standard procedures for monitoring and diagnostic air-conduction measures, and (3) standard procedures for bone-conduction measures.

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* Adapted from ASHA vol. 20 No. 4, April, 1978. This has been modified slightly to avoid test procedure variability. Removing such procedural variability decreases the likelihood of poor test-retest reliability.

** Editor's Note: The set of "Guidelines for Manual Pure-Tone Threshold Audiometry" was approved by the ASHA Legislative Council November 1977. The following members of the ASHA Committee on Audiometric Evaluation developed these guidelines: Vincent Byers, Joseph B. Chaiklin, James T. Graham, Norma T. Hopkinson, Z.G. Schoney, Francis L. Sonday, and Wesley R. Wilson, Chairman. ASHA encourages the professional community to use these guidelines.

DETERMINATION OF PURE-TONE THRESHOLDS

Some of the factors that influence the manual assessment of pure-tone thresholds are (1) the instructions to the individual, (2) the response task required of the individual, and (3) the examiner's interpretation of the individual's response behavior during the test.

Instructions. The instructions shall be phrased in language appropriate to the listener and shall indicate

1. the response task,
2. that the person is to respond whenever the tone is heard, no matter how faint it may be,
3. the need to respond as soon as the tone comes on and to stop responding immediately when the tone goes off,

4. that each ear is to be tested separately.

Response Task. Overt responses are required from the listener to indicate when the tone goes on and off. Any response task meeting this criterion is acceptable. Examples of commonly used responses are (1) raising and lowering the finger, hand, or arm and (2) pressing and releasing a signal light switch.

Interpretation of Response Behavior. The primary parameters used by the tester in determining threshold are latency of response, present of on- and off-responses and number of false responses.

1. The latency of the on-responses should be consistent. If the first response to a tone in an ascending series is slow, present a 5-dB higher tone and the response should be without hesitation.
2. Each suprathreshold presentation should elicit two responses-an on-response at the start and an off-response at the end of the tone. Listeners who are unable to signal correctly the termination of the tone, following proper instruction and reinstruction, may be demonstrating auditory problems and be in need of more detailed testing.
3. False responses may be of two types (1) a response when no tone is present (false-positive), or (2) failure to respond when a tone that is audible to the listener is present (false-negative). Either type complicates the measurement procedure. Reinstruction may reduce the rate of either type. The rate of false-positive responses may also be reduced by such techniques as varying the time between audible tones, pulsing and warbling of the signal, or using pulse-counting procedures.

Determination of Threshold

The basic procedure for threshold determination consists of (1) familiarization with signal and (2) threshold measurement. The procedure is the same regardless of frequency, output transducer, or ear under test.

Familiarization. The listener should be familiarized with the task prior to threshold determination by presenting a signal of sufficient intensity to evoke a sharp and clear response. The step of familiarization assures the examiner that the listener understands and can perform the reponse task. The following two methods of familiarization are commonly used:

1. Beginning with the tone continuously on but completely attenuated, gradually increase the sound-pressure level of the tone until a response occurs.
2. Present the tone at a hearing level of 30 dB. If a clear response occurs, begin threshold measurement. If no response occurs, present the tone at 50 dB HL and at successive additional increments of 10 dB until a response is obtained.

Neither method requires the tester to make a prior assumption about the listener's threshold, in contrast with some methods in common use. The American Speech and Hearing Association recommends a method not requiring such an assumption.

Threshold Measurement. The method described is recommended as a standard procedure for manual pure-tone threshold audiometry.

1. Tone Duration. Threshold exploration is carried out by presenting continuous tones of 1-2 sec in duration.
2. Interval Between Tones. The interval between tone presentations shall be varied but not shorter than the test tone.
3. Level of First Presentation. The level of the first presentation of tone for threshold measurement is 10 dB below the level of the listener's response to the familiarization presentation.
4. Levels of Succeeding Presentations. The tone level of succeeding presentations is determined by the preceding response. After each failure to respond to a signal, the level is increased in 5-dB steps until the first response occurs. After the response, the intensity is decreased 10 dB and another ascending series is begun. (Note: An exception is as explained previously under Interpretation of Response Behavior--Latency)
5. Threshold of Hearing. Threshold is defined arbitrarily as the lowest level at which responses occur in at least half of a series of ascending trials with a minimum of three responses required at a single level.

When variations in the standard method are used, the audiogram form shall indicate the nature of the variation.

STANDARD PROCEDURES FOR MONITORING AND DIAGNOSTIC AIR-CONDUCTION MEASURES

Instrumentation and Calibration. Air-conduction audiometry shall be accomplished with an audiometer and earphones that meet the specifications of the American National Standard Specifications for Audiometers S3.6-1969, and appropriate to the technique being used--monitoring or diagnostic.

Test Environment. The test environment shall meet the specifications for allowable ambient noise detailed in The American National Standard Criteria for Permissible Ambient Noise During Audiometric Testing S3.1-1977. When the ambient noise exceeds the allowable value for a specific frequency, the threshold for that frequency may be recorded if the obtained threshold exceeds by 10 dB the difference between the ambient noise level and the allowable ambient level.

In the interest of listener and examiner comfort, the test room and examiner's work area should provide for proper control of temperature, air exchange, and humidity. In the interest of listener and examiner safety, sound-isolated areas must be provided with either or both visual and auditory warning systems. These warning systems should be connected to the building warning system (fire, civil defense).

Earphone Placement. The ear canal should be checked for blockage by cerumen or for collapse of canal without or with earphones. The earphones should be held in place by a headband with the earphone grid directly over the entrance to the ear canal. The earphones should be placed by the tester, not the listener. Long hair and other obstacles should be clear of the space under the earphone.

Frequency. The frequencies tested differ, depending on the technique used.

1. Monitoring Technique. Threshold assessment shall be made at 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz and 6000 Hz.
2. Diagnostic Technique. Threshold assessment shall be made at octave intervals of 250 Hz to 8000 Hz, except when a low frequency hearing loss exists, in which case threshold shall be assessed at 125 Hz, as well. When the difference between the values at any two adjacent octave frequencies from 500 Hz to 8000 Hz is 20 dB or more, intraoctave measurements should be completed.

Order. When appropriate information is available, the better ear should be tested first. The initial test frequency should be 1000 Hz, and then either higher or lower frequencies shall be assessed sequentially followed by a retest of 1000 Hz and the remaining frequencies. Selection of 1000 Hz as the initial test frequency rests largely on past convention rather than on substantial research evidence. Until evidence is developed in support of a different initial frequency, no persuasive reason exists to change past convention except for special populations (for example, severely hearing impaired) which may require a different initial frequency.

Masking for Diagnostic Audiometry. When the air-conduction threshold obtained in one ear exceeds the apparent bone-conduction threshold in the contralateral ear by 40 dB or more, appropriate masking shall be applied to the nontest ear. Since the procedures for masking are not confined to pure-tone measures, these procedures are not discussed in this set of guidelines.

Recording of Results. Results may be recorded in graphic or tabular form or both. Separate forms to represent each ear may be used.

1. Audiogram Form. When the graphic form is used, the audiogram shall be on cross-section paper, with the abscissas being frequencies on a logarithmic scale and the ordinates being hearing levels in decibels on a linear scale. It is recommended that one octave on the frequency scale be linearly equivalent to 20 dB on the hearing level scale. The vertical scale is to be designated hearing level (Decibels); the horizontal scale is to be labeled Frequency in Hz.

2. Audiogram Symbols. When the graphic form is used, the symbols presented in ASHA's Guidelines for Audiometric Symbols (1974) should be used.

Other pertinent information describing the test situation should be reported on the audiogram or test results form.

STANDARD PROCEDURES FOR BONE-CONDUCTION MEASURES

Instrumentation and Calibration. The testing should be accomplished with a wide-range audiometer as defined by ANSI specification S3.6-1969. The bone-conduction vibrator is to be calibrated to the Interim-Threshold Calibration Values (Appendix A, Table A4) of the American National Standard Specifications for Artificial Head-Bone for the Calibration of Audiometer Bone Vibrators S3.13-1972 and should incorporate the appropriate calibration for either frontal or mastoid placement. Note: In addition to this standard, one may use comparison values for other artificial mastoids Wilber, 1972).

Standard bone-conduction vibrator placement should allow mastoid or forehead placement. The test ear should never be covered for standard bone-conduction measurements. The contralateral ear will be covered when masking is being used. The tester is to place the tranducer(s) not the listener.

Frequencies. Thresholds should be obtained at octave intervals of 250 Hz to 4000 Hz. Testing at frequencies below 500 Hz demands excellent sound isolation for cases with normal or near normal sensitivity, but may be accomplished when such an environment is available.

Order. The initial frequency tested shall be 1000 Hz and then either higher or lower frequencies shall be tested sequentially followed by the remaining frequencies.

Masking. If the unmasked bone-conduction threshold is 10 dB better than either air-conduction threshold at the frequency, masking must be used. since the threshold values on which the calibration of bone vibrators is based were measured with masking noise in the contralateral ear, the tester may prefer always to use masking in the testing procedure.

Recording of Results. Results may be recorded in graphic or tabular form. A standard set of symbols has been delineated in Guidelines for Audiometric Symbols (1974) and is to be used with the graphic form (audiogram).

CONCLUSIONS

The guidelines for manual pure-tone threshold audiometry are

1. Instructions. Indicate response task in language appropriate for the listener.
2. Response Task. Use any overt response signaling both tone on and tone off.
3. Determination of Threshold:
   - A. Familiarization is accomplished by presentation of a signal at suprathreshold level.
   - B. Threshold exploration involves ascending presentations of short-duration tones with level based on response to preceding presentation. After each failure to respond, the level is raised 5 dB until a positive response is obtained. After a response, the intensity is decreased 10 dB and another ascending series initiated.
   - C. Threshold is defined as the lowest level at which responses occur in at least half of the ascents with a minimum of three responses required at a single level.
4. Frequencies:
   - A. Monitoring audiometry includes air-conduction thresholds at the frequencies of 500, 1000, 2000, 3000, 4000 and 6000 Hz.
   - B. Diagnostic audiometry includes both air-conduction and bone-conduction thresholds.
     - i. Air-conduction threshold is measured at the octave intervals of 250 hz to 8000 Hz (plus 125 Hz in the case of low frequency hearing impairment) and at intraoctave intervals of any two successive octaves between 500 and 8000 Hz that differ by 20 dB or more.
     - ii. Bone-conduction threshold is measured at the octave intervals of 250 Hz to 4000 Hz.
5. Instrumentation and Calibration. Audiometers are to be maintained to the current ANSI specifications.

NOTE: When the following guidelines and standards referred to in this document are superseded by an approved revision, the revision shall apply

1. American Speech and Hearing Association Guidelines for Audiometric Symbols (1974);
2. American National Standard Specifications for Artificial Head-Bone for the Calibration of Audiometer Bone Vibrators S3.13-1973; and
4. American National Standard Criteria for Permissible Ambient Noise During Audiometric Testing S3.1-1977.

APPENDIX D*

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* The references corresponding to each ASHA Guideline have been omitted. The reader is therefore directed to the original documents of the American Speech-Language-Hearing Association, if more information is required.

APPENDIX D

GUIDELINES FOR DETERMINING THE THRESHOLD LEVEL FOR SPEECH

The set of Guidelines for Determining the Threshold Level for Speech is the fourth in a series developed by the Committee on Audiometric Evaluation, under the office of Vice President for Clinical Affairs of the American Speech and Hearing Association (ASHA).

Prior guidelines presented a recommended set of procedures based on existing practice and research findings whereas this new set of guidelines present recommended procedures achieved by consensus. There is no clearcut evidence, either from research or accepted clinical practice, to recommend the procedure of any existing method as the standard method over any other existing method. These guidelines incorporate the basic concepts of previously published speech threshold procedures. At the same time, these guidelines are written to parallel as closely as possible the same method found in ASHA Guidelines for Manual Pure-Tone Threshold Audiometry.

The ASHA Guidelines for Determining the Threshold Level for Speech presents a standardized procedure that is quick and reliable. It also permits the flexibility to meet the majority of test situations that occur in a clinical setting. The spirit of these guidelines, as in prior guidelines, is not to mandate a single way of accomplishing the clinical process. The intention is to suggest a standard procedure that will improve interclinician and interclinic comparison of data that, in the final analysis, will benefit the people we service.

SCOPE

Speech threshold audiometry is a procedure for measuring an individual's intelligibility threshold for speech material. An individual's threshold for speech is defined as the level at which he can respond correctly to 50% of the test material presented to him. This threshold level is usually reported as the individual's hearing loss for speech.

Since the type of test material used, for example, monosyllabic words, polysyllabic words, and connected discourse, will yield different speech reception thresholds, the test material to be used for determining a listener's threshold must be specified. Spondaic words are specified as the standard test material. Spondee Threshold is the recommended term for reporting the speech threshold, rather than the more general term, speech reception threshold. Spondee Threshold (ST) specifies the test material used and eliminates the need for noting the type of speech material used. When the general term speech reception threshold is used, specification of the type of test material used is required (though it is often missing). Spondee threshold is an appropriate and precise title for reporting the hearing loss for speech.

Historically, the first speech tests were spoken or whispered messages at measured distances between the talker and the listener. These tests provided a gross estimate of the listener's ability to hear speech. Clinical speech audiometry developed from a need to quantify the listener's ability to hear speech. The Western Electric 4A (later 4C) test, a phonographic recording of spoken digits, was the first widely used recorded auditory test for determining hearing losses for speech (Fletcher, 1929). Later, Harvard's Psycho-Acoustic Laboratory (PAL) developed word lists that serve as the basic model for today's clinical measurement of the hearing loss for speech (Hudgins, et al., 1947). Central Institute for the Deaf published Auditory Tests W-1 and W-2 (Spondaic Word Lists), which were modifications of the PAL lists (Hirsh, et al., 1952).

The ST serves many clinical purposes. The basic purpose is to quantify the listener's hearing level for speech. The ST also establishes the base of the articulation function to determine the appropriate sensation level for speech discrimination testing. It serves as a validity check for the pure-tone audiogram. The ST provides diagnostic and prognostic value in the total audiometric battery. It is used in audiological rehabilitation, particularly in hearing aid evaluations.

These guidelines present a standard procedure for assessing the ST of a listener. The procedure provides a quick and reliable method for determining a listener's threshold for speech.

GENERAL CONSIDERATIONS FOR CLINICAL DETERMINATION OF THE ST

Instrumentation and Calibration

Speech audiometry shall be accomplished with a speech audiometer as defined and calibrated according to the American National Standard Specifications for Audiometers, ANSI S3.6-1969.

Test Environment

The test environment shall meet the criterion for background noise in audiometric rooms as specified by the American National Standard Institute Specification ANSI S3.1-1960 (R-1971).

Test Material

Spondaic words are the standard test materials. An alphabetized list of spondaic words is presented at the end of this Appendix. Eighteen spondaic words are the minimum number of spondaic words recommended for a test list.*

Recorded/Live Voice Presentation of the Test Materials

Either a recorded or a monitored live voice technique can be used to obtain the ST. Recorded presentation of the test material is the preferred procedure. The use of recorded material standardizes the composition and presentation of the test list. It allows for the control of uniform intensity of the test words. It ensures that each test word will be presented in the same manner to every client.

However, the use of recorded material does present some inconveniences to the clinician. The clinician may have to stop the recording to permit the client to respond to the test word before the next one is presented. Disc and tape recordings will show wear after a period of use, introducing distortion of the signal and noise into the test system. The clinician should be alert to these problems.

While recorded presentation is the preferred choice, clinical situations may arise which favor the use of a monitored live voice presentation.** When monitored live voice is used, it should be noted on the audiogram. Live voice affords some flexibility in the presentation of the test words.

The disadvantages of live voice presentation are the problems and difficulty in monitoring the test words to a consistent intensity level. In addition, each spondee must be presented in the same manner to every client.

Recording of Results

The ST shall be recorded in dB HL. The ST should be recorded for each ear on the same audiogram that contains the client's results for pure-tone audiometry. Additional space should be available to report other pertinent information that describes the test situation.

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* There may be circumstances or clients that require a modification of the standard word list. The selection of the spondees for a special test list should be made with consideration of the capabilities of the client to be tested. Some factors to consider are age, language facility, and the physical condition of the client. Different lists of spondees may be required for different clinical populations, for example, children, elderly persons, and neurologically impaired clients. A list of spondaic words developed for francophone patients is included at the end of this Appendix.

** There will not be a clinically significant difference in the level of the ST between the use of recorded or live voice presentation. The use of the 5-dB step increment appears to be the major contributing factor to nonsignificance between the two types of presentation.

Masking for Nontest Ear

When the obtained ST in one ear exceeds the apparent ST or a pure-tone bone conduction threshold at either 500, 1K or 2K Hz in the contralateral ear by 40 dB or more, appropriate maksing shall be applied to the nontest ear. Since the procedures for masking are not confined to ST measures, these procedures are not discussed in this set of guidelines.

DETERMINATION OF THRESHOLD

The basic procedure consists of instructions, familiarization, a series of ascending threshold determinations, and application of the criterion for the determination of threshold hearing level.

Instructions

The specific wording of the instructions must be phrased in language appropriate to the client and should

1. Orient the client to the nature of the task.
2. Specify the client's mode of response.
3. Indicate that the test material is speech material and specify that the client should respond with only words from the test list.
4. Stress the need for the client to respond at faint listening levels and encourage the client to guess.

Familiarization

The first step in the testing procedure is to familiarize the client with the exact spondees in the test list. This necessary step ensures that

1. The client knows the exact words in the test list.
2. The client can make an adequate response to each spondaic word, and
3. The clinician can score a client's response as correct or incorrect, based on the client's response pattern.

The clinician may read the test list to the client in a face-to-face situation. The client repeats each word on the list. The clinician may play the test list through the speech audiometer system to the client. The client repeats each word on the list.

At the conclusion of any of the above procedures, the clinician shall emphasize that the client is to respond only with words from the test list. Any spondee that the client has any difficulty understanding or repeating should be eliminated from the test list. Any spondee that the clinician has any difficulty understanding should be eliminated from the test list.

Familiarization of the test list is considered an essential step in the procedure. It must not be eliminated from the procedure.

Ascending Threshold Determination

The basic procedure follows as closely as possible the same method as outlined in the ASHA Guidelines for Manual Pure-Tone Threshold Audiometry. The basic procedure involves an ascending technique with sets of four different spondees presented at 5-dB step increments. Each ascending series is terminated when the client responds correctly to three or more spondees in a set, and a new ascending series is begun. Threshold for the hearing level of speech is defined arbitrarily as the lowest level in which half or more of the spondaic words are repeated correctly with the minimum requirement of two ascending sampling series. When variations in the standard technique are used, the nature of the variation shall be noted on the audiogram form.

Ascending Technique

1. Set the attenuation dial to its lowest setting, usually -10 dB HL, and present one spondee to the client. Ascending 10-dB step increments, present a spondee until the client responds correctly.
2. At 15 dB below the level of the client's first correct response, the first ascending sampling series is begun. A set of four spondees is presented at this level to the client. The level of presentation is increased in 5-dB step increments with a set of different spondees presented at each level until the client responds correctly to three or more spondees in the set.
3. The second ascending sampling series is begun 10 dB below the level at which the client responded correctly to three or more of the spondees in the first ascending series. A set of four spondees is presented to the client. The level of presentation is increased in 5-dB step increments with a set of four different spondees presented at each presentation level until the client responds correctly to three or more spondees in the presentation set.
4. A new ascending sampling series is begun at 10 dB below the level at which the client responded correctly to three or more of the spondees in the preceding sampling series. The sampling series procedure is continued until the client meets the criterion for threshold determination.

Criterion for Determining of Threshold

Threshold is defined arbitrarily as the lowest level at which at least half of the spondaic words are repeated correctly with a minimum requirement of two ascending sampling series.

NOTE: When the following Guidelines and Standards referred to in this document are superseded by an approved revision, the revision shall apply:

1. American National Standard Criteria for Background Noise in Audiometer Rooms S3.1-1960; and
2. American National Standard Specifications for Audiometers S3.6-1969.

ALPHABETICAL LIST OF SPONDAIC WORDS
For Anglophone Patients

airplane
armchair
backbone
baseball
birthday
blackboard
cookbook
cowboy
doormat
drawbridge
duckpond
eardrum
earthquake
eyebrow
greyhound
hardware
headlight
horseshoe
hot dog
ice cream
inkwell
mousetrap
mushroom
northwest
nutmeg
oatmeal
outside
padlock
pancake
playground
railroad
stairway
sunset
toothbrush
whitewash
woodwork

LIST OF SPONDAIC WORDS
For Francophone Patients*

Listes de disyllabes reputés faciles pour la recherche traditionnelle du S.I.P.*

liste A	liste B	liste C	liste D
programme	orange	modele	parole
couloir	modele	carotte	horloge
fromage	horloge	docteur	programme
docteur	programme	couloir	départ
départ	carotte	parole	docteur
horloge	docteur	départ	voiture
carotte	parole	orange	modele
parole	voiture	programme	couloir
orange	départ	fromage	carotte
voiture	couloir	horloge	fromage
modele	fromage	voiture	orange
fromage	programme	parole	modele
horloge	carotte	docteur	parole
modele	fromage	orange	couloir
parole	modele	programme	voiture
départ	docteur	modele	fromage
voiture	orange	départ	docteur
couloir	voiture	carotte	horloge
carotte	parole	voiture	programme
docteur	horloge	fromage	orange
orange	départ	couloir	carotte
programme	couloir	horloge	départ

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* Benfante, H., Charbonneau, R., Arseneault, A., Zinger, A., Marti, A., Champoux, N. (1966). Audiometrie vocale. Montreal: Hôpital Maisonneuve

APPENDIX E*

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* The references corresponding to each ASHA Guideline have been omitted. The reader is therefore directed to the original documents of the American Speech-Language-Hearing Association, if more information is required.

GUIDELINES FOR ACOUSTIC IMMITTANCE SCREENING OF MIDDLE-EAR FUNCTION

BACKGROUND

A Committee on Audiometric Evaluation was established in 1971 by the Legislative Council for purposes of 1) studying procedural techniques and electroacoustic characteristics of audiometric instruments used in the evaluation of auditory function, and 2) developing guidelines applicable to the practice of clinical audiometry. In 1974, the Committee's "Guidelines for Identification Audiometry" were accepted by the ASHA Legislative Council. The primary emphasis of the Guidelines was on pure-tone air conduction screening procedures with primary application to the school-age population. Although immittance[1] measurement was recognized as an important part of the identification process, the Committee did not propose guidelines for this procedure due to lack of a strong research foundation. In 1975, following an increase in research and clinical data, a Subcommittee on Impedance (Immittance) was formed. Measurement was established for the purpose of preparing guidelines for acoustic immittance measurement screening procedures. The guidelines that follow have been developed by the Subcommittee and present recommended procedures based on existing practice and research findings. As such, these guidelines should be considered as interim and subject to revision pending further clinical and research findings.

RATIONALE

Immittance measurements are used for the identification of conductive otologic abnormality. Conductive abnormality is usually middle-ear disease, practicularly in children (Wehrs and Proud, 1958; Brownlee et al. 1969; Kaplan et al. 1973; Howie et al. 1975). Initiating screening programs for detecting middle-ear abnormality has often seemed a discouraging venture because early subtle effects of middle-ear disease may create only minimal hearing loss (less than 25 dB), the nature of the disorder can be transient in many cases, and medical management is varied.

Medical considerations have traditionally been thought to be the major reason for detecting middle-ear disease. However, Brooks (1978) reviewed pertinent literature on middle-ear disease consequences and concluded that minimal hearing loss and fluctuating middle-ear conditions have educational, social, and psychological considerations as well. Studies cited by Brooks, and additionally those cited below, support that persistent middle-ear disease can lead not only to medical complications (Vernstein, 1977; Lithicum, 1977; Mawson, 1977) but also to significant hearing impairments (Friedmann, 1970; Mawson, 1977) and educational barriers (Holm and Kunze, 1960; Ling; 1969; Menyuk, 1969; Kaplan et al, 1973; Howie, 1977; Needleman, 1977; Brooks, 1978).

These latter studies have related recurrent middle-ear disease and fluctuating hearing loss with linguistic, intellectual, social, and educational developmental lags in children. Fluctuating hearing losses and subtle middle-ear problems are often not seriously regarded at the time because they result in minimal hearing loss which is not always identified by an audiometric screening program. Of concern is that the problem remains unrecognized until the cumulative effects of serious disease of the ear or developmental lags become apparent.

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*The set of "Guidelines for Acoustic Immittance Screening of Middle-Ear Function" was approved by the ASHA Legislative Council in November 1978.

[1] Immittance: the term used to denote either acoustic impedance or acoustic admittance. (The term is incorporated into these guidelines for the purpose of consistency with terminology used in the proposed Standard for Aural Acoustic Immittance Instruments being developed by the ANSI-Immittance working group.)

The transient nature of the disease has encouraged the tendency to allow the situation to resolve without intervention, and in many cases this is successful. However, not all cases resolve, and the critical factor is the predictability of which cases will resolve and which will not. Brooks appropriately asks can we "justifiably afford to ignore a pathological condition on the assumption that in most cases it will, over a period of time, ameliorate without intervention."[2]

Although effective and necessary, present audiometry screening programs do not always identify the individual with middle-ear problems. Inconsistent relationships between hearing loss and middle-ear disease are well documented (Jordan and Eagles, 1961; Eagles et al, 1967; Cohen and Sade, 1972; Harker and Van Wagoner, 1974; Brooks, 1973; McCandless and Thomas, 1974; Northern, 1975; Cooper et al, 1976). Separate techniques for identification of hearing loss and middle-ear abnormality appear more efficient than attempting to use only one procedure for identification of both.

The development of immittance guidelines, therefore, does not imply a need for replacement of conventional pure-tone air-conduction hearing screening procedures. Acoustic immittance screening assesses middle-ear function; pure-tone audiometric screening evaluates auditory senstivity. Thus, acoustic immittance measurements can provide supplementary information to the traditional pure-tone air-conduction screening program.

The goal of a program oriented toward immittance screening evalutions of middle-ear function is to maximize the identification of individuals who have middle-ear disorders when they exist (test sensitivity), and identify individuals who are normal when they are, in fact, normal (test specificity). Many difficulties exist in achieving test sensitivity and specificity.

Screening programs in the past have had difficulty accomplishing this goal primarily due to the use of pass/fail and referral criteria. In addition, the use of tympanometry alone (with the exclusion of the acoustic reflex) in the early screening programs limited the amount of available information on which to base such criteria. In fact, Brooks (1976) has suggested that the acoustic reflex is the more sensitive of the two. In response to immittance screening needs, most equipment manufacturers are now providing an easily accessible method of incorporating both tympanometry and the acoustic reflex into the procedure. This has allowed the capacity for obtaining more information with subsequent tightening of the pass/fail criteria.

Additional factors, however, will continue to cause difficulties when children are referred for medical evaluation following abnormal results on an immittance screening. One difficulty is the afore-mentioned transient nature of middle-ear disorders. Another difficulty is the occurrence of immittance measurement results which fall outside the normal range but do not constitute significant medical problems upon examination. This problem can at least be partly related to the time lag that may exist between identification and medical examination. However, the primary underlying factor is fluctuating middle-ear conditons. This recognized factor supports a need for recognition of a population that is "at risk" and may require observation and monitoring especially in the early years of educational work. Identification of these individuals, in children may never lead to medical referral but may very well require special seating, attention and/or supplementary educational services to negate the development of educational problems.

It has also been apparent that controversies exist in the medical community as to what constitutes treatable middle-ear disease and how medical management should be conducted. While it is recognized and appreciated that there is no standard medical approach to treatment of middle-ear effusion at this time, this situation need not discourage or negate the importance of identification of middle-ear abnormalities. Identification of a problem and information on its prevalence and nature is often necessary before attempts can be made toward determining means of resolving the problem. Separate from the medical aspects, identification of children with potential fluctuating hearing loss is felt to be necessary for proper educational management. Although recognizing that further research is necessary for determining the significance and treatment of subtle middle-ear disorders, screening programs can identify potential at risk populations and, in addition, can presently identify those persons with more obvious middle-ear disease who can, in fact, benefit from medical intervention.

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[2] Brooks, D.N., Maico Audiological Library Series, part 1, vol. XV, No. 8, p. 1, 1978.

Since immittance measurements are objective, rapid, and efficient, a screening application for use with large populations is entirely practical. The immittance measurement has several advantages for a screening approach: sound-treated environments are not necessary, testing is rapid, no response is required from the individual being tested, the procedures are minimally limited by age, and the procedures are useful for difficult-to-test individuals.

These latter statements are neither meant to imply nor to negate a need for mass screening. Rather, they are meant to convey the practical impression that those programs wishing to incorporate middle-ear screening progams for large populations should find it possible to do so. Some large special populations, such as Eskimo children (Ling et al, 1969; Kaplan et al, 1973; Harker and Van Wagoner, 1974), children with cleft palate (Paradise, 1976; Bess et al, 1975; Bess et al, 1976), institutionalized psychotic children (Geffner and Wever, 1977), Australian oboriginal children (Lewis et al, 1975), native Indian children (Roberts, 1976), developmentally disturbed children (Bayshore, 1977) and deaf children (Brooks, 1974) reportedly have a high incidence of middle-ear disorders. In such populations screening procedures may have significant application. Also, programs already undertaking pure-tone air-conduction screening of school populations should be free to consider middle-ear screening as a possible supplementary procedure which can offer added information in the achievement of a well-balanced identification program.

Thus, the early identification and treatment of middle-ear disease, especially in children and special populations, appears important. Undetected and untreated problems can lead to progression of disease, which can create irreversible changes in the conductive mechanism of the ear (Jaffe, 1977) and may additionally create unnecessary educational barriers.

PURPOSE

The purpose of these guidelines is to recommend a set of procedures and parameters for accomplishing rapid and efficient identification of middle-ear disorders using acoustic immittance screening measurements. The procedures involve evaluation of the middle-ear status using both tympanometry[3] and acoustic reflex[4] measurements and are based on existing clinical experience and research findings. The spirit is not an approach for accomplishing middle-ear screening, but rather to provide an outlined procedure for guidance.

SCREENING MIDDLE-EAR FUNCTION

Procedural Considerations

Population to be Screened

The following recommendations emphasize acoustic immittance screening procedures for children since the incidence of conductive otologic abnormality is greater for children than for adults. However, these procedures may also be applied to other populations.

For school-age populations, it is recommended that screening procedures be administered annually to children of any higher grade who have a known history of middle-ear problems. Annual screening for children in the lower grades is appropriate because of the higher incidence of middle-ear disease in younger children in the lower grades is appropriate because of the higher incidence of middle-ear disease in younger children

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[3] Tympanometry: a procedure used to measure changes in acoustic immittance at the eardrum as air-pressure changes are artificially induced into a hermetically-sealed ear canal. The recorded results are known as a tympanogram.

[4] Acoustic Reflex: a contraction of one or more muscles of the middle-ear in response to the presentation of a suprathreshold stimulus. Evidence of the presence of the reflex action is characterized by a measured change in the acoustic immittance.

Routine screening for children younger than 7 months of age is not presently recommended since research has demonstrated inconsistent results for this group (Paradise et al, 1976).

Personnel

Screening programs should be under the direct supervision of appropriately qualified professionals. "Appropriately qualified professional" for the purpose of these guidelines is defined as an audiologist, physician, or speech-language pathologist with appropriate training in immittance screening techniques. It is recognized that supportive personnel will often be conducting many of the activities of the screening programs under supervision. Supportive personnel should have completed an appropriate level training program for preparation.

Guidelines

The guidelines concern the parameters of measurement and do not discuss specific measurement techniques such as type of ear tips, insertion of probe-tip assembly, instructions to person being tested, color of pen recordings and so forth. These are left to the discretion of the examiner and most are usually discussed in the equipment manual provided by the manufacturer.

Equipment

Acoustic immittance instruments for screening programs should have as a minimum the capability for tympanometry and for monitoring an acoustic reflex at a specified intensity level.

The instrumentation should contain an automatic recording system which produces a permanent record of the test results.

Calibration

Pending adoption of ANSI standards for calibration of immittance instruments, electroacoustic calibration procedures should be performed at least monthly according to the manufacturer's specifications. During active periods of screening, test cavity calibration checks should be performed daily before initial testing, and once midday. The probe-unit should be checked routinely for obstructions. Further assessment of the system is necessary when immittance results appear spurious.

The acoustic reflex eliciting signal should be checked monthly and be calibrated according to the ANSI S3.6-1969 requirements for pure-tone calibration of standard earphones. For ipsilateral reflex stimuli, a 2 cc coupler must be used.

Since there is presently no available accompanying equipment provided by the manufacturer for determining accuracy of the pressure system, it is recommended that a U-tube water manometer be used at least monthly.

Calibration of the automatic recording unit should be performed according to manufacturer's specification at least montly. Daily calibration checks of all systems should be performed during active screening periods.

Pump System

An automatic constant-rate pump system with a recording system is recommended. The instrumentation may include an automatic recording system in order to reduce screening time, reduce the possibility of recording error by nonprofessionals, and produce a permanent record of test results.

Air-Pressure Range

The recommended air-pressure range used should cover a minimum of +100 to -300 mm H_2O. The greater range in the negative direction is recommended since abnormalities in children are usually revealed in this dimension. Determining the pressure status beyond -300 mm H_2O would contribute little to the screening data and would unnecessarily increase screening time. Although negative pressure status is known to fluctuate over short periods of time (Lewis et al. 1975), such pressures pose sufficient threat to the integrity of hearing (Flisberg et al, 1963; Cooper et al, 1975) to warrant rescreening and at risk classification.

Probe-Tone Frequency

A low-frequency probe-tone between 220 and 300 Hz is recommended since the bulk of screening data used the low-frequency and there is insufficient information on screening with higher frequencies. Also, the low-frequency probe-tone is the only one universally available on present screening equipment.

Rate and Direction of Air-Pressure Change

There are insufficient data to recommend guideline procedures. In the interim a consistent approach within each program is recommended for best test-retest comparison and reliability.

Measurement Units

ANSI guidelines for measurement units are not available at present. In the interim a consistent approach within each program is recommended.

Frequency for Acoustic Reflex Eliciting Signal

The recommended eliciting signal is a pure tone of 1000 Hz. This frequency is chosen because it is less likely to be influenced by mild negative pressure affects for lower frequencies, which may elevate reflex eliciting levels, and because it is less likely to be viewed as a hearing screener for high-frequency hearing loss. In addition, this frequency appears to have a lower acoustic reflex threshold than most other pure-tone frequencies (Jepsen, 1963; DiSogra, 1978), and it was found to be the most consistent eliciting frequency (compared to 500, 2000, 4000 Hz) to show a reflex in screening program with children ages 6-14 years (DiSogra, 1978).

Level of Acoustic Reflex Eliciting Signal

Levels recommended are a 100 dB HL signal for contralateral stimulation or a 105 dB SPL signal for ipsilateral stimulation.

The acoustic reflex in normal ears is elicited between 75-95 dB HL for pure-tones (Peterson and Liden, 1972). Negative pressure levels are known to elevate acoustic reflex thresholds (Peterson and Liden, 1972; Skinner et al, 1977). Skinner et al (1977) found the mean reflex threshold elevated by 2.5 dB for ipsilateral stimulation and 5 dB for contralateral stimulation. Although wishing to compensate for negative pressure effects, the use of unusually high intensity levels can lead to artifact and may create a startle response. Therefore, it is recommended that a level at the upper limits of the normal range with an additional compensating level for mild negative pressure effects be used.

Pressure for the Acoustic Reflex Test

The acoustic reflex test should be administered at the tympanogram peak pressure point when it is identified in order to maximize the possibility of obtaining a response, or at ambient air pressure when no pressure peak can be identified.

Criteria for Pass-Fail

For screening purposes, middle-ear pressure, and presence or absence of the acoustic reflex, are the only factors involved in referral criteria. Static immittance values are not included in these criteria due to the large variability in this parameter as reported in the literature (Jerger, 1970; Feldman, 1974).

Pass-fail and referral criteria are summarized in Table 1.

Table 1. Middle-Ear Screening Criteria

Classification	Results of Initial Screen	Disposition
I. PASS	Middle-ear Pressure Normal* or Mildly positive/negative** and Acoustic Reflex Present***	Cleared; no return
II. AT RISK	Middle-ear Pressure Abnormal*** (and Acoustic Reflex present) or Acoustic Reflex Absent (and middle-ear pressure normal or mildly positive/negative)	Retest in 3-5 weeks a) If Tymp. and AR fall into Class I, PASS b) If Tymp. or AR remain in Class II FAIL and refer.
III. FAIL	Middle-ear Pressure Abnormal and Acoustic Reflex Absent	Refer

*Normal: Pressure peak in range ± 50 mm H_2O.

**Mildly Positive/Negative: +50 to +100 mm H_2O, -50 to -200 mm H_2O.

***Present: Pen or meter needle deflection judged to be coincident with the reflex eliciting stimulus at levels of 100 dB HL for contralateral stimulation, 105 dB SPL for ipsilateral stimulation at 1000 Hz.

****Abnormal peak outside the ranges described for Classification I.

Disposition

Individuals demonstrating middle-ear pressure within the normal range (± 50 mm H_2O) or mildly positive/negative (+50 to +100 mm H_2O, -50 to -200 mm H_2O) and presence of an acoustic reflex to a 1000 Hz pure tone at 100 dB HL for contralateral or 105 DB SPL for ipsilateral stimulation, pass middle-ear screening and require no retesting (Classification I).

Individuals revealing middle-ear pressure outside this range and with absence of acoustic reflex response, fail the screening. These individuals are not retested as part of the screening program but are referred to audiological and medical examination (Classification III).

Individuals who have middle-ear pressure outside the normal or mildly positive/negative range with the acoustic reflex present, and individuals who have the acoustic reflex absent with normal or mildly positive/negative middle-ear pressure may be considered "at risk" (Classification II) and should be restested in a 3-5 week period. At the time of retest the individual is passed if the tympanometry and acoustic reflex results are consistent with Classification I specifications. The individual is failed and referred if the tympanometry and the acoustic reflex results are consistent with Classification III specifications or persist in Classification II specifications.

Individuals in Classification II and III should be identified within any educational setting as to the referral disposition and to the possible presence of fluctuating hearing loss. School programs may wish to correlate results of middle-ear screening with results of hearing screening for a balanced program toward the achievement of: 1) the identification of those with educationally significant hearing problems, and 2) the identification of medically significant problems.

APPENDIX F*

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* The references corresponding to each ASHA Guideline have been omitted. The reader is therefore directed to the original documents of the American Speech-Language-Hearing Association, if more information is required.

GUIDELINES FOR IDENTIFICATION AUDIOMETRY*

The set of Guidelines for Identification Audiometry is the second of a series developed by the Committee on Audiometric Evaluation, under the Office of Vice-President for Clinical Affairs of the American Speech and Hearing Association (ASHA).

Each of the guidelines presents a recommended set of procedures based on existing clinical practice and research findings. The spirit of these guidelines is not to mandate a single way of accomplishing the clinical process; rather the intent is to suggest standard procedures that, in the final analysis, will benefit the persons we serve. The intention is to improve interclinician and interclinic comparison of data thereby allowing for a more effective transfer of information.

The specific purpose of these guidelines is to detail procedures for accomplishing rapid and efficient identification of hearing impairment, particularly for use with young children.[1] As such, they represent an update of the procedures for identification audiometry for school-age children specified in the Journal of Speech and Hearing Disorders Monograph Supplement Number 9, "Identification Audiometry" (Darley, 1961). The current need for these guidelines is apparent with the development of increasing numbers of identification audiometry programs administered by state departments of education or health, the development of state mandatory special education statutes, and Medicaid guidelines for Early and Periodic Screening, Diagnosis, and Treatment (EPSDT).

For the most part, the philosophy and procedures laid out in these guidelines are based on and supported by published data. ASHA invites data-based input for future modifications of the guidelines.

SCOPE

A primary goal of identification audiometry using pure-tone air-conduction stimulation is to identify persons who have hearing impairments that interfere with or that have potential for interfering with communication. These guidelines focus on use with children of nursery-school age through grade three because early identification of communicative problems in this age group will permit maximum habilitation and avoidance of potential educational problems. Belkin, et al. (1964) have reported successful large scale individual pure-tone screening tests with children as young as three years of age. In addition, it is this age group which, in our society, is most often involved in the formal educational process through preschools and regular schools. While these guidelines focus on use with young children, they are equally applicable for use with older children and adults.

The guidelines are designed for rapid and efficient identification of hearing impairment. A basic assumption behind the guidelines is that identification audiometry is usually conducted in the relatively poor acoustic environments of schools and offices. Consequently, the procedures recommended are designed to be robust enough to be valid in a wide range of test settings. Naturally, it would be desirable for all identification audiometry to be conducted in acoustic environments that are controlled, but such environments are seldom available.

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*The set of "Guidelines for Identification Audiometry" was approved by the ASHA Legislative Council in November 1974.

[1] The Guidelines for Identification Audiometry are written with emphasis on the testing of children; however, the approach is also appropriate for use with adults. A method of identification audiometry using a tracking procedure, sometimes called self-recording monitoring audiometry, is also used with adults in military and industrial settings. ASHA considers Guidelines for Identification Audiometry Using a Threshold Tracking Procedure deserving of a separate document. When the writing task is undertaken ASHA recommends that representatives of military and industrial groups should be included.

Identification audiometry is only one component of a hearing conservation program. A well-balanced program will include screening, rescreening, threshold audiometry, referrals for audiologic and medical evaluations, education and habilitation planning, and counselling for parents and teachers. Too often the sole goal is referral for medical evaluation rather than referral for consideration of communicative needs of those who fail screening procedures. Once people have been identified by the program, they should be followed regularly to insure that their communication and medical needs are met. It is pointless to identify people who have hearing impairments unless there is a concurrent follow-up program to handle their habilitative, educational, and medical needs.

Finally, these guidelines apply only to the use of pure-tone air-conduction screening for the purpose of identifying persons who have hearing impairment that interferes with or that has the potential for interfering with communication. Research (Eagles, 1961; Eagles, Wishik, and Doerfler, 1967; Roberts, 1972) demonstrates that pure-tone air-conduction screening is inefficient for the purpose of identifying many persons who have conductive ear pathology. Thus, if the purpose of an identification audiometry program is also to identify persons with conductive ear pathology, ASHA suggests the simultaneous use of otologic screening, or supplemental procedures such as impedance (otoadmittance) measurements or pure-tone bone-conduction measurements. However, ASHA cannot specify any standardized screening procedures that employ impedance or bone-conduction measures because sufficient research data on such procedures are unavailable at the present time.

IDENTIFICATION AUDIOMETRY

The following recommendations emphasize identification audiometry for children using a manually administered, individual, pure-tone air-conduction screening procedure.

Children To Be Screened

Individual limited-frequency screening should be administered annually to children of nursery-school age through grade three and to high-risk children.[2] The time the program saves by emphasizing the lower grades permits appropriate attention for the high-risk group and focuses the program's efforts during the years when identification of communication problems can lead to intervention that will forestall serious educational, psychological, and social problems. Some school systems may elect to screen routinely after grade three at three- or four-year intervals (Darley, 1961). Others may find that a cost vs benefit analysis does not justify routine screening beyond grade three (Downs, Doster, and Wever, 1965). To determine the merit of routine screening after grade three, more data appear to be necessary.

Procedure

Individual Screening. Individual as opposed to group screening is recommended. The Massachusetts Test (Johnston, 1948) is an example of a group pure-tone test that achieved great popularity and is still used in some states. It requires written responses and, consequently, like most group screening tests is limited to children above the second grade. Other limitations of group tests are calibration and maintenance problems of multiple earphones, increased set-up time and excessive time spent in retesting false-positive failures. All of these factors combine to increase the total time required for the screening program without increasing accuracy. Many group tests may appear to save time but the time taken to set up, check calibration, score answer sheets, and retest excessive failures may result in no saving of time.

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[2] Examples of high-risk children are those who: (a) repeat a grade, (b) require special education programs, (c) are new to the school system, (d) were absent during a previously scheduled screening exam, (e) failed a threshold test during the previous year, (f) have speech problems, language problems, or obvious difficulty in communication, (g) are suspected of hearing impairment or have a medical problem associated with hearing impairment (children with recurrent or chronic problems such as allergies may require audiometric monitoring). Additional examples of high-risk children are given in Darley (1961, p. 36).

In addition to the above high risk categories the Group recommends the addition of those children experiencing sudden unexplained academic difficulties.

Manual Method. A manual versus an automatic method is recommended because it is applicable with children down to three years of age. There is no known evidence that a self-recording or other type of automatic method is possible and effective with young children. Certainly, if an effective and more rapid automatic method is developed, its use should be considered.

Signal

Type. Pure-tone signals shall be used. Many different stimuli have been used to screen children and adults for the purpose of identifying persons with hearing impairment. Before audiometers were widely available, phonograph recordings were used to produce repeatable stimuli as in the Western Electric Fading Numbers Test. The Fading Numbers Test had a variety of defects: the most notable was its tendency to pass children with hearing deficits in the range above 500 Hz. Other screening tests that employ speech signals are vulnerable to the same defect.

Test Frequencies. Test frequencies shall be 1000 Hz, 2000 Hz, and 4000 Hz. The Conference on Identification Audiometry (Darley, 1961) recommended the frequencies 1000, 2000, 4000, and 6000 Hz. The recommendation for 500 Hz was ambiguous but the conference's intent appears to have been to eliminate 500 Hz except for very quiet test environments.

Melnick, Eagles, and Levine (1964), in a study which tested the conference's recommendations, used 500 Hz; however, all of their tests were conducted inside double-walled audiometric rooms. Melnick, Eagles, and Levine found that the conference's recommended test was highly efficient except at 6000 Hz, whicn produces too many failures. The variable interactions between earphones and ears at 6000 Hz (Villchur, 1970) among other considerations, made 6000 Hz a poor choice for inclusion in an identification audiometry program. The use of 500 Hz in order to assuage the user that he will discover all middle ear pathologies in a group of children is contraindicated by the hard data that is available (Eagles, 1961; Eagles, Wishik, and Doerfler, 1967; Roberts, 1972).

When an inordinate number of failures is expected at 4000 Hz, then 3000 Hz at 20 dB HL might be considered as the alternate test signal. There is insufficient research data at the present time to validate that the information obtained warrants the routine inclusion of 3000 Hz.[3]

Screening Levels. Screening levels shall be 20 dB HL (re: ANSI-1969) at 1000 Hz and 2000 Hz and 25 dB HL at 4000 HZ. It is acceptable to screen at 20 dB HL at all three frequencies, but if 4000 Hz is not heard, output should be increased to 25 dB HL. Since most children will hear all three tones at 20 dB, the hearing level dial can remain at one setting for the entire test. It is important to remember, however, that 25 dB is the specified level at 4000 Hz.[4]

Results

Failure Criterion. Failure to respond at the recommended screening levels at any frequency in either ear shall constitute failure.

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[3] ASHA invites active research on the addition of 3000 Hz to the screening format. Research studies also would be helpful to determine whether 3000 Hz could be substituted for 4000 Hz as a better predictor of subtle communicative problems among school-age children.

[4] ASHA is interested in active research concerning screening levels, since there is a great deal of strong feeling expressed concerning the issue, but very little hard data are available.

Mandatory Rescreening. All failures should be rescreened preferably within the same session in which they failed but definitely within one week after the initial screening. Removing and repositioning the phones, accompanied by careful reinstruction, markedly reduces the number of failures. Wilson and Walton (1974) reported a 52% reduction in failures by rescreening. The rescreening, using the same frequencies, levels, and failure criterion, is an essential procedure for improving the efficiency of a screening program.

Disposition of Failures. Failures on rescreening should be referred for audiologic evaluation by an audiologist. Some persons, particularly young children, will fail both the screening and rescreening procedures and then yield normal thresholds on an audiometric evaluation. Therefore, a hearing impairment should not be considered identified until after receiving an audiometric evaluation by an audiologist. An example of a program employing this referral format has been described by Campanelli, Krucoff, and DiLosa (1964). The following referral priority for audiologic evaluation is recommended for those children who fail the screening and rescreening procedures:

a. Binaural loss in both ears at all frequencies
b. Binaural loss at 1000 and 2000 Hz only
c. Binaural loss at 1000 or 2000 Hz only
d. Monaural loss at all frequencies
e. Monaural loss at 1000 and 2000 Hz
f. Binaural or monaural loss at 4000 Hz only.

The constraints placed on individual programs will determine the referral format, but the hearing conservation program supersisor should be responsible for providing case management necessary to guarantee appropriate referral for audiologic and medical consultation. In addition, the supervisor should secure educational assistance, if necessary, for students during and after medical therapy or audiologic habilitation. These duties are emphasized because the primary goal of school hearing conservation programs is to reduce the negative effects of communicative problems that are secondary to hearing loss, rather than simply to identify children who pass or fail a screening test.

PROCEDURAL CONSIDERATIONS

Adherence to the following procedural recommendations should facilitate successful implementation of the ASHA guidelines for identification audiometry.

Personnel

Identification audiometry programs should be conducted or supervised by an audiologist. After appropriate training, support personnel may administer audiometric screenings and rescreenings under the supervision of an audiologist. If properly trained professionals are not involved in supervising an identification audiometry program, an inordinate number of false-positive failures and false-negative passes may occur, thus undermining the validity of the program. Without reservation, the audiologic evaluation should be administered by an audiologist.

Instructions

Instructions are critical in all audiometric procedures but particular care must be taken in instructing children. Instructions should emphasize the importance of responding "right away even when the beeps sound far away." Groups of children can be instructed at one time. Those waiting for the test profit from watching others being tested. Pantomime may have to accompany verbal instructions for the very young child or the difficult-to-test person, particularly if a conditioned play response is required rather than a hand or verbal response. Careful reinstruction is an important part of the rescreening process. Frequently children fail because they have misunderstood instructions. This is particularly true of children in the three- to six-year age range.

Time

At the third-grade level the entire screening including earphone placement, occupies less than one minute. For younger children more time may be necessary. To avoid unnecessary failures with younger children, it is sometimes desirable to present more than one signal per frequency if there is no response. The net effect is a saving of time because the more careful screening process reduces the number of children who fail and require rescreening.

Acoustic Environment

The acoustic environment is an important variable in screening audiometry. Usually school environments are not too noisy for screening at frequencies above 1000 Hz, but sometimes ambient noise will interfere with screening at 1000 Hz. The 1000-Hz to 4000-Hz range was selected for the ASHA guidelines because it is less vulnerable to invalidation by ambient noise and because most significant hearing impairment will include failure in this range. The allowable ambient noise levels in the region of the test tone are shown in Table 1. Although screening at 500 Hz is not recommended, there is nothing inherently wrong in screening at 500 Hz in an appropriate environment such as a double-wall test room (Melnick, Eagles, and Levine, 1964). If an individual wishes to include 500 Hz, the allowable ambient noise levels are also included in Table 1.

Careful snug placement of the earphones increases attenuation of ambient noise by the earphone-cushion assembly. On the other hand, ASHA does not encourage the use of large sound-attenuating circumaural earphone assemblies (for example, Auraldomes and Otocups). Below 1000 Hz, these devices provide limited improvement in attenuation of ambient noise relative to the attenuation produced by the MX-41/AR cushion (Webster, 1954; Cos, 1955; Benson, 1971). The advantage provided above 1000 Hz is not needed because ambient noise is generally weak above 1000 Hz and the MX-41/AR cushion provides relatively good attenuation of the weak high-frequency ambient noise. Furthermore, the large earphone assemblies are awkward for small children, and they increased test-retest variability in the higher frequencies.

Some persons have mistakenly assumed that sound-attenuating headsets eliminate the need for a quiet test environment, or worse, that they substitute for a sound-isolated audiometric test booth. In extremely noisy environments an audiometric test booth is often the only means of providing an environment quiet enough for screening audiometry. The sound-attenuating headsets provide the least benefit in the frequency range where it is needed most.

Audiometric Equipment and Calibration

Audiometers used for screening purposes shall meet the ANSI S3.6-1969 requirements for either a limited-range or narrow-range audiometer. Audiometers used for audiometric evaluation shall meet the ANSI S3.6-1969 requirements for a wide-range audiometer. Audiometric calibration to ANSI S3.6-1969 specifications should occur regularly, at least once every year, following the initial determination that the audiometer meets specifications.[5] All of the ANSI specifications should be met, not just sound pressure level. Frequency errors, overshoot, and transient clicks are just a few of the problems that may invalidate a screening test. The sound pressure output of each audiometer should be checked at least every three months (preferably more often) in a 6 cc coupler. In addition, a daily listening check should be performed to determine that the audiometer is grossly in calibration and that no defects exist in major components.

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[5] Studies on audiometer calibration suggest that, upon receipt, most audiometers may never have been in complete calibration (Eagles and Doerfler, 1961; Thomas, et al., 1969; Walton and Williams, 1972). This information underscores the importance of initial calibration of audiometers, and indicates that they should be checked to meet ANSI specifications before they are used in a screening program. It has been shown that when specifications are met initially, the audiometers generally remain stable (Walton and Wilson, 1974).

Table F-1. Approximate allowable octave band ambient noise levels (SPL re: 20 micropascals for threshold measurements at Zero HL (re: ANSI-1969) and for screening at the ASHA recommended levels (re: ANSI-1969). In test environments that have fluctuating noise levels, caution must be used in applying the maximum value shown in this table. The committee has used the best information available in the literature to support the levels, and is basing its recommendation on these levels until additional information is available.

Test Frequency Octave Band Cutoff Frequencies	500 300 600	1000 600 1200	2000 1200 2400	4000 2400 4800
Allowable ambient noise for threshold at zero HL (re: ANSI-1969)*	26	30	38	51
Plus ASHA screening level re: ANSI-1969	20	20	20	25
Resultant maximum ambient noise allowable for ASHA screening	46	50	58	76

*The allowable ambient noise levels for ANSI-1969 Zero HL threshold measurements were calculated by subtracting from the maximum allowable noise levels specified in the ANSI standard (S3.1, 1960) the difference between the ANSI-1951 and ANSI-1969 standards for pure-tone audiometers. In effect, the lower SPLs specified at Zero HL in the 1969 standard require quieter test spaces to measure normal listeners' thresholds.

Reports to Parents

Recommendations for audiologic and medical evaluations should be based on local realities. The language used in notices sent to parents about screening or rescreening results should avoid diagnostic conclusions and alarming predictions. Remember that the hearing impairment is not confirmed until the audiometric evaluation is administered. Personal contact would be preferable to sending notices, if possible. Some persons become overly concerned, others express no concern, and still others would like to cooperate but fear the expense that may be involved. If parents believe that their child can "hear," despite what a hearing screening suggests, tact and persuasion will be required to convince them that they may be in error. The word "fail" probably should be avoided in reporting screening results. The reporting aspect of programs for identification audiometry requires more time and thought than some programs have provided in the past.

SUMMARY

ASHA recommends a manually administered, individual, pure-tone, air-conduction screening procedure for accomplishing identification audiometry. The purpose of this procedure is to identify rapidly and effectively those persons with hearing impairment that interferes with communication or that has the potential for interfering with communication. The procedure is designed to be used with children as young as three-years old, although it is applicable for use with adults.

The recommended identification audiometry procedure is as follows. Audiometric screening should be at 20 dB HL (re: ANSI-1969) at the frequencies of 1000 Hz and 2000 Hz and 25 dB HL at 4000 Hz. Failure to respond at the screening level at one or more frequencies in either ear is the criterion for failure. An audiometric rescreening should be administered the same day or no later than within one week to all persons failing the initial screening. An audiologist should administer an audiologic evaluation to persons failing the rescreening. If a hearing impairment is identified by audiometric evaluation, referrals should be made to meet the person's habilitation, educational and medical needs.

Several procedural considerations are vital to implementing successfully the ASHA Guidelines for Identification Audiometry. An audiologist should conduct or supervise an identification audiometry program, although nonprofessional support personnel may be used for the screening procedures after appropriate training. Careful instructions are very important, particularly for young children. Ambient noise levels should not exceed 50 dB SPL at 1000 Hz, 58 dB SPL at 2000 Hz, and 76 dB SPL at 4000 Hz using a sound level meter with octave band filters centered on the screening frequencies. Audiometric equipment should initially meet all the ANSI S3.6-1969 specifications and be rechecked at least annually. The sound pressure output at the phones should be checked at least every three months, and listening checks for any gross malfunctions should be made daily. Finally, appropriate reporting of screening results should avoid diagnostic conclusions and encourage further evaluation for persons not passing the screening procedures.

Note: When the following Standards referred to in this document are superseded by an approved revision, the revision shall apply:
(1) American National Standard Specifications for Audiometers S3.6-1969; and
(2) American Standard Criteria for Background Noise in Audiometer Rooms S3.1-1960.